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Highly fluctuating prices for secondary materials are seen as risks in planning decisions, thus causing uncertainty and acting as a barrier to the use of secondary materials in production processes. Futures markets can provide a mechanism for transfer of price risk and decrease the uncertainty over future prices; however, commodities must possess certain characteristics to be successfully traded on futures markets. Wastepaper and ferrous scrap were analyzed for these characteristics and the results suggest that futures trading in these commodities is feasible. The social and private benefits from scrap futures markets would probably differ, however, and thus there is justification for government to take an active role in implementing and monitoring futures markets for scrap materials.

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by

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment, and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

A substantial proportion of the materials from the solid waste stream is not recycled. The rate of recycling, for some materials, as a percentage of total available tonnage, is actually declining. This report examines the feasibility of futures markets as an economic policy for increasing the rate of recycling.

Francis T. Mayo, Director
Municipal Environmental Research
Laboratory

ABSTRACT

The unusual price volatility of secondary material markets introduces risk into planning decisions based on the use of recycled materials. The price volatility creates uncertainty over future prices and thus acts as a barrier to the use of secondary materials in production processes. This study assesses the feasibility of initiating futures markets in certain secondary materials as a mechanism for the transfer of price risk and for decreasing uncertainty over future prices.

Conversations with commodity exchange officials and a review of pertinent literature reveals that to be successfully traded on futures markets commodities must have certain characteristics in common. Wastepaper and scrap steel are analyzed as to whether they have these same characteristics. Given certain caveats, it is argued that futures contracts in these commodities would be feasible. Furthermore, it is shown that the availability of these contracts would lessen the impact of uncertainty on production decisions concerning secondary materials.

Because of a possible divergence between social and private returns from listing a scrap futures contract, the government has a potential role in sponsoring the design, initiation, and inspection of such a contract.

This report was submitted in fulfillment of Grant No. R804309-01 by the Environmental Law Institute under sponsorship of the U.S. Environmental Protection Agency. This report covers the period June 15, 1976 to January 15, 1978, and work was completed as of January 15, 1978.

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SECTION I

INTRODUCTION

Scrap markets are characterized by unusual price volatility. By all accounts, this price variability hinders investment in the secondary materials industry and adversely affects recycling levels. This study investigates the feasibility of futures markets in scrap materials as a mechanism for reducing the adverse impact of variable prices.

The rationale for studying a futures market in secondary materials will be presented on Section 3. In essence, it will be argued that the price volatility in the scrap markets introduces a large degree of risk into planning decisions based on scrap inputs and outputs because of uncertainty over future prices for these materials.* The inability of industry to cope with this price risk biases input use away from secondary materials and toward primary materials.

In light of the discussion in Section 3, this study will focus on two of the several functions of a futures market: (1) providing a market to transfer future price risk; and (2) upgrading the quantity and quality of market information concerning future prices. Section 4 contains a brief introduction to futures markets and futures trading, as well as a discussion of potential and empirically verified impacts of futures trading on the cash market for a commodity.**

Having established this background information, two fundamental questions will be addressed. First, can scrap materials be successfully traded on a futures market? In order to answer this question, it will first be necessary to determine whether secondary materials share certain basic characteristics with commodities currently traded on futures markets. Second, if a futures market in a scrap material (e.g., ferrous scrap) were established, how would it be used by industry members to achieve the desired results. Sections 5 and 6 investigate these issues.

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*Throughout the remainder of this paper, "risk" will be defined as variance in income.

**For the purposes of this report, the term "cash" will refer to market transactions not involving futurity. In part, forward contracting agreements are distinguished from transactions on futures markets in that they do not take place on an organized exchange (the different characteristics of futures markets and forward contracting agreements are discussed more fully in the beginning of Section 4).

The discussions in Sections 5 and 6 raise one last set of questions. If a futures market in secondary materials is, as will be agrued, a good idea, why isn't a futures contract in wastepaper or ferrous scrap being traded right now? Parts of the answer will surface in all the sections, but Section 7 contains a formal answer. In short, the listing of a scrap futures contract may prove less beneficial to the listing exchange than to society as a whole. Section 7 suggests some possible solutions to this divergence between private and social benefits.

This study focuses on two specific materials as candidates for futures trading: wastepaper and ferrous scrap. These two commodities are particularly affected by price volatility and, therefore, future price uncertainty. In addition, forward markets for their respective primary substitutes do not exist as they do for several other scrap materials (i.e., copper, zinc, lead, and tin). These forward markets for primary materials, as will be shown later, can be, and currently are, used to transfer future price risk for the scrap product.

The conclusions reached are clear. Provided that care is taken in the design and initiation of each contract, a scrap futures market is feasible. It will confer direct benefits on the scrap industry members who trade in the futures market as well as those who do not. Furthermore, a scrap futures market should benefit society as a whole through a more efficient allocation of capital and labor in the production and processing of primary and secondary materials.

SECTION 2

SUMMARY AND CONCLUSIONS

With only minor qualifications, futures trading in ferrous scrap and wastepaper is feasible. The qualifications, in order of importance, are: (1) a private exchange or government agency must educate industry members as to the benefits and usefulness of futures trading so that a hedging demand for a scrap futures contract can be established; and (2) a standard contract grade that is acceptable to industry members must be defined. A particular qualification, specific to wastepaper, is that unless it can be shown that prices for different grades of wastepaper are highly correlated, contrary to the results presented in this report, a contract in one grade of wastepaper may not be useful for other potential hedgers who deal in grades different from the contract grade.

It should not be difficult to convince industry members that risk management, income stabilization, and the resulting easier credit terms from lending institutions are tangible benefits from futures trading. A futures market is a business tool to be used in conjunction with normal cash market transactions. Except for the concept of futurity, for which many industry members concede a need, a properly designed futures market would represent transaction terms that are familiar to industry members and thus easily incorporated into their business decision-making process.

Problems relating to contract grade specification, as well as other aspects of contract specification, are discussed later and will not be presented here. Resolution of these issues must come from discussions between an exchange and industry members. In addition, this report suggests a potential governmental role in this process.

Although the impact of a wastepaper or ferrous scrap futures contract on the recycling rates in those industries is impossible to quantify because of the hypothetical nature of this study, qualitative projections can be made. Scrap buyers and sellers would be less hesitant to rely on scrap inputs or to invest in secondary processing facilities because of (1) the ability to transfer the risk of future price changes through hedging; (2) increased market information flows; and (3) improved financing terms. There would follow a corresponding increase in the amount of scrap materials used in production processes and, therefore, an increase in relative recycling rates. Furthermore, there is the possibility that a scrap futures contract would indirectly reduce the impact of other market imperfections on recycling levels. For example, a scrap futures market might give a sense of legitimacy to the sellers' side of the market and make it more amenable to vertical integration by user mills.

One, if not the major, theme of this report is the need for extensive industry participation in the design and initiation of a scrap futures contract. Without such participation, it is doubtful that the aforementioned conditions vital to a successful contract could be met.

As a first step, it is recommended that formal presentations on futures markets and their use be made to industry members. Besides acting to disseminate information on futures markets, these presentations would provide a forum for eliciting industry responses, comments, and ideas. To generate and hold interest, the presentations should be directed, as much as possible, to the particular concerns of the scrap industry. Accordingly, the group responsible for the presentations should be familiar with both futures markets and scrap markets. Representatives of a commodity exchange would be desirable as discussants, since they have experience in such matters. But because exchange officials may have higher priorities, government-sponsored presentations may be needed.

A further role for the government, as suggested in Section 7, is to conduct in-depth studies on the specific aspects of scrap market transactions that need to be standardized for a successful futures contract--in particular, contract grade specification, delivery requirements, pricing terms, and inspection procedures. To be done properly, these studies would require extensive interviews with industry members and close cooperation with an interested commodity exchange. Here again, a commodity exchange is the most likely candidate for conducting such research, but government sponsorship may be required.

A scrap futures contract should provide significant benefits to the scrap industry and society as a whole. Industry acceptance poses the principal obstacle to successful scrap futures contracts. An effort to secure this acceptance might be well rewarded.

SECTION 3

UNCERTAINTY AND RESOURCE ALLOCATION IN SECONDARY MATERIALS MARKETS

This section will attempt to establish two basic propositions: (1) that secondary materials markets are characterized by an unusually high degree of price uncertainty; and (2) that uncertainty in the markets for secondary materials has deterred new investment in scrap processing facilities. Discussion of these propositions will be prefaced with a brief review of the underlying causes of price uncertainty for secondary materials.

CAUSES OF PRICE UNCERTAINTY FOR SECONDARY MATERIALS

The familiar economic constructs of supply and demand functions are a useful point of departure for the discussion of price uncertainty. Prices for a commodity are considered uncertain when they are difficult to predict. A common proxy for predictive difficulty and uncertainty is the observed variation in past prices. In terms of supply and demand, prices are more variable when supply and demand functions are unresponsive to price and when either function is subject to large shifts. Figure 1, below, depicts two fundamentally different situations. In Panel A, the supply function is elastic--it is responsive to price signals. The large shifts in demand from D to D^1 do not result in significant changes in market price. In Panel B, by contrast, both the supply and demand functions are inelastic. Relatively small shifts in either demand or supply lead to large changes in market price.

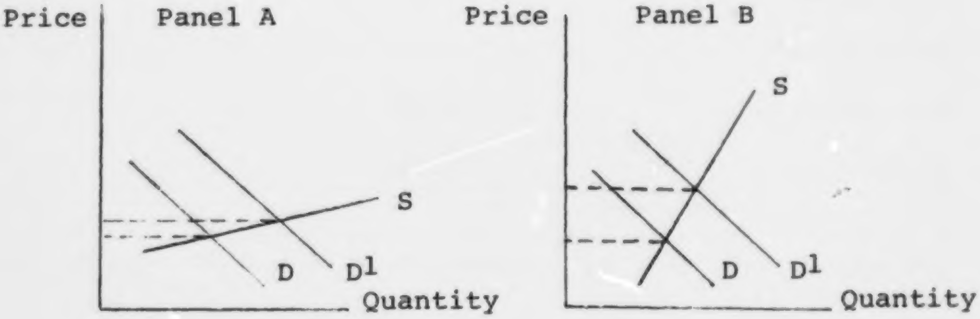

Figure 1. Variation in market prices.

In an earlier report to the Environmental Protection Agency, the Environmental Law Institute estimated the supply and demand elasticities for wastepaper, scrap steel, and secondary lead. In addition, earlier estimates by others for secondary copper were tabulated. These elasticity estimates are reproduced in Table 1.

All of these elasticities are low, particularly in comparison with the primary material supply elasticities. For example, the price elasticity of supply for primary lead was estimated at 1.0, and for copper at 1.7, whereas the respective secondary supply price elasticities were 0.48 and 0.32. These figures illustrate one of the underlying causes of price variation in secondary material markets--the low supply and demand elasticities for many scrap materials.

Economic theory demonstrates that the elasticity of demand for an input to production process depends upon: (1) the number and availability of substitute materials; and (2) the cost of the input relative to the selling price of the final output. If there are many substitutes in the production process or if the input price is high relative to the value of output produced, a comparatively small change in the price of the input may cause substantial changes in the quantity demanded, and an elastic demand schedule will result. To a certain extent, both of these considerations apply to secondary materials. In general, scrap materials compete with primary materials as inputs to production processes, although the range of substitution possibilities of secondary inputs for primary inputs depends on a host of factors, including the grade of scrap to be used, the production process, and the type of output. For example, most copper scrap

TABLE 1. SUPPLY AND DEMAND ELASTICITIES FOR SECONDARY MATERIALS*

Material	Supply Elasticity	Demand Elasticity**
Wastepaper	0.40	0.08
Scrap steel	1.12	0.64
Secondary lead	0.48	0.21
Scrap copper	0.32	0.87

* Sources: for wastepaper and scrap steel, see reference [3]; for secondary lead, see reference [2]; and for scrap copper, see reference [13].

**For secondary lead and scrap copper, the demand elasticity refers to the industry demand curve for primary and secondary inputs combined.

substitutes perfectly for primary copper, whereas the degree of substitution for aluminum scrap and primary aluminum will depend on the output being produced: scrap aluminum substitutes perfectly in the production of castings, but not at all in the production of sheet aluminum [42, p. 15].

It is more difficult to generalize about the impact of the cost of scrap relative to the final product on the elasticity of demand for scrap materials. This relationship depends not only on factors influencing substitution possibilities between secondary and primary materials, but also on the elasticity of demand for the final product. For example, if demand for the output of an electric furnace is inelastic, a small change in the price of scrap would have little effect on the quantity of ferrous scrap demanded for this use, even though scrap costs might represent over one half of the cost of producing steel.* Similarly, because the cost of tetraethyl lead made from scrap lead is very small relative to the value of leaded gasoline, and because demand for gasoline is fairly inelastic, a change in the price of scrap lead would have little impact on the quantity of scrap lead demanded for the purpose of making tetraethyl lead additives.

The total impact of the standard economic effects of substitution, relative costs, and demand elasticity for the final product on the elasticity of demand for secondary materials is indeterminate. At best, it can be said that these factors alone cannot account for the low elasticities of demand for secondary materials; other forces must also act to reduce demand elasticities.

The low demand elasticities for secondary materials may arise in part from the backward integration into primary material supply sources by many users of both primary and secondary inputs. The reasons for this backward integration have not been fully explored, but appear to include the users' desire for: (1) insurance against uncertainty in input availability and protection against possible cartelization of primary material supplies [28]; and (2) favorable tax treatment of primary production which can be enhanced even further in a vertically integrated operation.** By owning and operating primary supply sources, user firms accept a certain level of sunk costs which provide an incentive to those firms to rely upon primary inputs in preference to secondary materials.

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* A study for the Environmental Protection Agency estimated the total per net ton costs of producing molten steel from an electric furnace to be $53.04; scrap costs were estimated at $31.10 of that total [34, p. 262].

** For a more complete discussion of vertical integration in the secondary materials user industries and its impact on resource recovery, see [8].

Furthermore, demand for wastepaper and ferrous scrap appears to be tied to the capacity cycles in the paper and steel industries. Increased demand for paper and steel products strains the capacity of these industries to produce woodpulp and pig iron, their respective primary inputs. An outward shift in the demand for secondary inputs results as firms are forced to rely on scrap materials as substitutes for pulp and pig iron in their production processes. A decline in the demand for paper and steel products shifts the demand for secondary materials back to more normal levels. Figure 2 depicts this process. During normal capacity utilization levels, demand for scrap inputs is represented by D_1. An increase in the demand for final products shifts the demand for scrap inputs to D_2, with a corresponding increase in short-run supply, Q_1 — Q_2, and price, P_1 — P_2. As demand for the final products decline, demand for scrap shifts back to D_1, and price decreases to P_2. This two-level demand structure for secondary materials and the vertical integration of user mills imply that the demand for secondary materials will be less elastic and subject to larger fluctuations than would be the case for primary materials.

The supply elasticities for secondary materials are low for an entirely different set of reasons. In the first place, rising costs are encountered as the more marginal supplies are brought to market. In addition, most of the prompt industrial scrap is brought to market irrespective of the price of scrap, since receipt of any positive price for industrial scrap is normally preferred to paying for its disposal in a landfill.

Another factor leading to low supply elasticities for secondary materials, particularly wastepaper and ferrous scrap, is the low level of inventory holdings by user mills and scrap

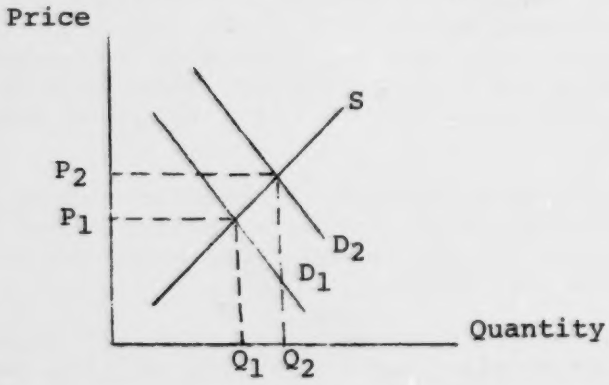

Figure 2. Demand shifts for scrap inputs.

dealers.* Most paper and steel mills keep inventories of scrap from which they may draw as the need arises. But because of the high cost of storing scrap inventories, due to low value per unit volume, inventories may represent only a month or two of expected needs. Wastepaper is an extreme case where low value per unit volume and perishability act in concert to restrict normal inventories to not more than one month's needs.

During periods of high demand, as described earlier, mills' inventories are depleted and they must buy scrap in the cash market. Like the mills, scrap dealers and processors cannot afford to hold large inventories, and as these inventories are depleted, the price of scrap begins to rise without, at least initially, a corresponsing increase in supply. The lack of supply response results from the lag time required for the dealer to generate new sources of scrap and for new members to enter the industry. For this and other reasons, the supply of scrap is price inelastic in the short run.

THE DEGREE OF UNCERTAINTY

The net result of inelastic supply and demand functions, small industry inventories, and fluctuating demand is a widely varying price for most secondary materials. Table 2 reports the coefficient of variation for selected primary and secondary materials.** The price series used for each commodity was the monthly wholesale price for the period 1971-1975. Wastepaper and ferrous scrap show the largest price variation. In general, the secondary materials exhibit a larger degree of variation in short-run prices than do the corresponding primary materials.***

As mentioned earlier, price variation is only a proxy for predictive difficulty and uncertainty. It is possible to

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* A description of the interaction between demand fluctuation and low inventory holdings to produce price variability for wastepaper can be found in [40, pp. 148-51].

** The coefficient of variation is a parameter that measures the variance in a data series and through standardization allows for the comparison of the variances of different series. Specifically, it is computed by dividing the standard deviation by the mean. A value of zero indicates that individual observations in the data series never move away from the mean; the larger the value, the more variation.

***The coefficient of variation for primary tin prices relative to secondary tin is one exception to this observation. The authors know of no reasonable explanation for this discrepancy.

TABLE 2. COEFFICIENT OF VARIATION OF MONTHLY WHOLESALE PRICES FOR SELECTED COMMODITIES, 1971-75*

Commodity	C.V.
All industrial commodities	0.143
Refined petroleum products	0.393
Woodpulp (all grades)	0.425
Wastepaper (all grades)	0.440
Paperboard products	0.219
Iron ore	0.175
Iron and steel scrap (all grades)	0.458
Iron and steel products	0.229
Copper wirebar (domestic origin)	0.169
Copper scrap (base)	0.286
Aluminum scrap (base)	0.361
Primary aluminum ingot	0.218
Lead pig (common)	0.210
Scrap lead (battery plates)	0.289
Nickel cathode sheets	0.175
Scrap nickel anodes	0.223
Tin pig, grade A	0.367
Black tin pipe scrap	0.250
Zinc slab (prime western)	0.044
Old zinc, New York	0.236

*All prices from U.S. Department of Labor, Bureau of Labor Statistics, _Wholesale Prices and Price Indexes_, Annual Supplements, 1971-1975.

imagine a situation where the coefficient of variation indicates relatively volatile prices, but where the prices are predictable. Figure 3 shows two hypothetical price series and their respective means, μ_A and μ_B. Price series A has a higher coefficient of variation, but at the same time is more predictable than series B when past prices are used to predict future prices. This is because the coefficient of variation describes the difference between the mean of the price series and the actual price observation. It is clear that the observations on series B are closer to their mean than observations for price series A.*

If futures prices are relatively predictable from past demand and supply relationships, the impact of uncertainty caused by volatile prices can be lessened. Short-run future price expectations can be used to establish forward contracts, thereby guaranteeing input supplies or market outlets, and to guide production and inventory decisions.

We contend here that reliable expectations concerning futures prices for secondary materials are more difficult to formulate because of their extreme price fluctuations. A comparison of the predictability of futures prices using the most recent past price for primary and secondary materials supports this proposition. Our results were unambiguous (see Appendix A). Secondary materials prices were much more difficult to predict than were primary material prices.

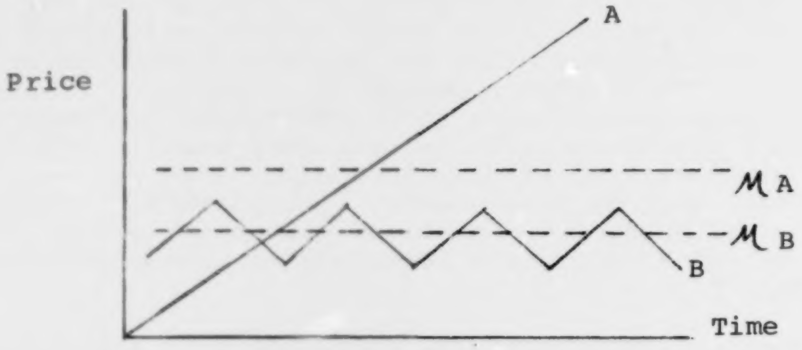

Figure 3. Time profile of two hypothetical price series.

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*This situation may be a partial explanation for the relatively high coefficient of variation for woodpulp prices which have, historically, been increasing, and, since they are basically administered prices, are not subject to downward pressure.

THE IMPACT OF UNCERTAINTY ON RESOURCE ALLOCATION

It will be argued here that price uncertainty created by the volatile nature of scrap markets biases short-run production decisions and longer-run investment decisions in favor of the more price-stable primary materials. Furthermore, this bias is reinforced by the inability of scrap markets to provide any mechanism for coping with the risk created by price uncertainty. Although the literature on decision-making under uncertainty is new and perhaps incomplete, a few preliminary observations are worth noting.

In his general treatment of the theory of the firm under price uncertainty, Sandmo showed, among other things, that the output under price uncertainty will be less than where output price is known [37]. Using a slightly different assumption concerning the behavioral motives of the firm, Stevens argued that uncertainty will lead to socially optimal capital and labor input levels which are lower than would be the case under certain price conditions [42]. The net result is that output and input use levels will be lower under demand uncertainty than under certain price and demand conditions.*

Because of uncertainty over present and expected prices for scrap materials, short-run production and inventory decisions are, at best, difficult to make in an orderly and rational manner. The result is a disincentive to rely on secondary materials as inputs to production processes. In addition, it is reasonable to assume that longer-run decisions concerning investment in secondary processing technology are also affected. In general, one would expect, everything else being equal, that investment in the paper and steel industries is biased away from recycling technology. The uncertainty in the scrap markets causes firms to discount expected returns from secondary investment alternatives more heavily than returns from investment in primary technology. It is well documented that unpredictable market fluctuations, leading to uncertainty over present and expected prices for scrap, are a major deterrent to increased recycling of wastepaper and ferrous scrap.**

The impact of uncertainty is exacerbated in the scrap markets by the inability of producers or consumers to protect themselves from the inherent risk of an uncertain market environment. Typically, through forward contracting and/or vertical integration, firms are able to decrease the effects of demand and supply uncertainty. But precisely because of high price uncertainty, buyers and sellers of scrap are not willing to enter into long-term agreements, even though industry members admit that forward contracting is necessary to stabilize demand and supply conditions. Forward contracts involving wastepaper and ferrous scrap are rarely for more than a month or so in advance. As one industry member remarked, "Who wants to sign a contract calling for delivery of a carload of scrap in three months when no one has any idea what it will be worth?"* Neither side of the market wants to commit itself to a price that is unpredictable.

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* The authors recognize that this discussion of uncertainty and the theory of the firm barely scratches the surface of the recent work in the field, most of which is beyond the scope of this report. For a more complete understanding of this topic, the reader is referred to [37, 38, 42, 27].

**See [1, p. 30] and [5, p. 52].

Furthermore, vertical integration by user mills back to the scrap dealers, at least in the past, has not been a viable alternative.** First, as mentioned earlier, management of large user mills have developed a major short-run commitment to primary input sources for tax purposes and other reasons. Second, the geographical dispersion of the market makes it unsuitable, from the mills' viewpoint, for acquisition. Third, and probably most important, the social stigma attached to scrap dealers in general deters mill management from direct activity in scrap markets [8, p. 116].

The remainder of this report examines the feasibility of futures markets as a mechanism for rectifying the impacts of uncertainty on resource allocation in scrap markets. An organized futures market in certain scrap materials would provide a means of forward trading in these commodities, would generate forward prices, and would allow industry members to hedge some of the risk of making forward commitments in scrap.

The next section will describe how futures markets provide a market for forward trading and risk management, in addition to increasing the flow of market information.

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* From a telephone conversation with a ferrous scrap buyer (who requested that he not be identified).

**Obviously, the following discussion on vertical integration is most applicable to firms using some secondary inputs but relying mainly on primary inputs.

SECTION 4

FUTURES MARKETS AND THEIR ECONOMIC IMPACT ON THE CASH MARKET

FUTURES MARKETS

Organized futures trading in the United States began in 1865 when wheat futures contracts were listed on the Chicago Board of Trade. Informal markets satisfying many of the same needs were common before that date. In Europe and the United Kingdom, organized commodity exchanges, of one form or another, date back to the late sixteenth century.*

Although different in form and structure from the current U.S. practices, all of these exchanges developed to satisfy the need for a central marketing place for commodity trading. In a sense, this central marketing place, by bringing buyers and sellers together, lowered the transaction costs of trading in an uncertain market environment. In the United States, the early futures markets were for agricultural commodities. Today, futures contracts are traded in such diverse commodities as plywood, frozen orange juice, copper, foreign currencies, and interest rates. Table 3 lists some of the nonagricultural commodities traded on U.S. futures markets and the dates when trading was initiated.

The characteristics of futures markets that distinguish them from other markets (for example, cash, contract, or forward delivery markets) have been enumerated by Gray [19, pp. 2-3]. Futures contracts are traded on an organized commodity exchange under the rules promulgated by the exchange. The contract, which calls for delivery of a commodity at some future date, is standardized as to quality and quantity to be delivered as well as to all other terms of delivery. Only the day of delivery within the delivery month is left to the discretion of the seller. For example, the copper contract traded on the Commodity Exchange, Inc. (Comex) in New York calls for delivery of 25,000 pounds of 99.9 percent pure copper cathodes. The delivery months are January, March, May, June, July, September, and December. Delivery can be made from any

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*For a more detailed discussion of the historical development of U.S. futures markets, see [22, pp. 71-94].

TABLE 3. SELECTED LIST OF NEWLY INTRODUCED NON-AGRICULTURAL FUTURES CONTRACTS

Commodity	Year of introduction	Volume traded in 1974 (number of contracts)
Gold (Commodity Exchange Inc.)	1974	25,050
Lumber (Chicago Mercantile Exchange)	1969	3,528
Plywood (Chicago Board of Trade)	1969	383,322
Mercury* (COMEX)	1967	86
U.S. Treasury Bills (International Monetary Market)	1976	294,829**
British Pound (IMM)	1972	11,842
Mexican Peso (IMM)	1972	82,054
Government National Mortgage Association 8% Securities (Chicago Board of Trade)	1975	113,538**

* Ceased trading in 1975 because of lack of interest.

**Volume traded from January-November 1976.

one of six Comex warehouses located across the country. A seller gives notice of delivery by issuing a warehouse receipt, a negotiable instrument transferring title to the copper in the warehouse, at any time during the delivery month for which he has sold a contract.

Table 4, reproduced from the Wall Street Journal, gives the futures prices for copper on Wednesday, April 27, 1977. Opening, closing, high, and low prices during the day are quoted for each delivery month up to a year in advance. On that day, for example, trading in July copper futures opened at 65.2¢ per pound and closed at 64.2¢, down .40¢ from the previous day's selling price. The high and low prices for the July contract during 1977 were 83.2¢ and 58.4¢, respectively. A total of 6,250 contracts were traded that day.

A futures market is an impersonal market in that actual buyers and sellers are unknown to each other. It is also a very public and competitive market, since all trades in a particular commodity are made by open outcry in the specified trading area, or "pit," of the exchange. Floor traders, who must be members of the exchange, sell to and buy from a clearinghouse which is usually part of the exchange.*

TABLE 4. COPPER FUTURES PRICE QUOTATIONS*

Month	Open	High	Low	Close	Change	High	Low
May	64.10	64.30	63.20	63.20	-.40	82.60	57.30
June	---	---	---	63.70	-.40	---	---
July	65.20	65.30	64.20	64.20	-.40	83.20	58.40
Sept.	66.10	66.30	65.20	65.20	-.40	81.80	59.20
Dec.	67.60	67.70	66.70	66.70	-.30	76.60	60.80
Jan. 78	68.00	68.00	67.10	67.10	-.30	75.90	61.70
March	68.80	68.90	68.00	67.90	-.30	76.70	67.20
May	69.60	69.60	68.80	68.70	-.30	76.40	68.10

*Estimated sales, 6,250; sales Tues., 3,815. Copper (CMX)-25,000 lbs.; cents per lb.-S (Wall Street Journal, 28 April 1977)

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*Besides acting as an intermediary between buyers and sellers, the clearinghouse oversees all trading activities.

Although it is a legally binding commitment to deliver or purchase the specified commodity, a futures contract does not transfer title of commodity ownership. A position with the clearinghouse, long if a futures contract has been purchased or short if one has been sold, can be liquidated by taking an offsetting position in the market or by taking delivery of the commodity. For example, if a trader were to buy a December copper contract in June and sell a December contract in September, his net position with the clearinghouse would be zero after the September transaction had been made.

There are two categories of traders in futures contracts: hedgers and speculators. Speculators buy and sell futures contracts in hopes of profiting from favorable movements in the futures prices. They have no position in the cash market and rarely intend to make or take delivery of the commodity in which they are trading. The activity of speculators promotes liquidity in futures markets by making it easier for hedgers and other traders to establish trading positions.

Hedgers, on the other hand, use futures markets to reduce the risk of an unfavorable movement in the cash price that would affect a position they hold or plan to hold in the cash market.* Normally, a hedge consists of taking a position in the futures market that is the opposite of a planned or actual position held in the cash market. A buyer in the cash market becomes a seller of futures contracts, and vice-versa.

A futures market is not a delivery market. Actual delivery in satisfaction of a futures contract is rare; many contracts traded on commodity exchanges experience less than 1 percent delivery rates [14, p. 8]. Oddly enough, the assurance that a standard grade and quantity of a commodity will be delivered eliminates the desire to take delivery, since the contract specification and/or the delivery terms usually do not represent the most profitable terms for actual purchase or sale. In most cases, the buyer or seller is better off negotiating a cash market transaction and using the futures market to hedge that decision. As a result, the hedging and forward pricing roles of a futures market, which we will discuss in the next section, become more important than the delivery role [19, p. 6].

Futures markets exist mainly to facilitate the holding of contracts [51]. In a sense, they act as a substitute for a later transaction that may take place in the cash or forward contract market [19, p. 7]. Futures markets, therefore, supplement those markets already in operation, rather than replace existing ones.

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*For the purposes of this paper, an extremely simplified notion of hedgers' motivations and of hedging has been adopted. For a more realistic definition and discussion of these concepts, see [49] and [50].

ECONOMIC IMPACTS OF FUTURES MARKETS

It is useful to divide the economic impacts of futures trading on the cash market into three general categories: (1) the impacts on pricing in the cash market; (2) the impacts on risk management; and (3) the impacts on market information. The specifics of each will be discussed in turn.

Pricing Function of Futures Markets

Futures markets are often described as price discovery mechanisms [32, p. 45]. A futures market acts as a central clearing device for traders in a commodity. These traders buy and sell futures contracts based on their expectations and information concerning current and future demand and supply conditions. Traders with good forecasting tools and skills and better information are rewarded at the expense of less skilled traders. This competition assures generation of good predictions of future prices. In fact, the prices generated on futures markets represent unbiased predictions of future cash prices based on the currently available market information [18, p. 73]. Therefore, while the June futures price of a contract, calling for December delivery, will not necessarily equal the actual cash price in December, it does represent an unbiased prediction of the cash price for the commodity in December. Thus, by providing a forum for the assimilation and dissemination of market information and expectations, futures markets act as price discovery mechanisms.

The forward prices generated on futures markets signal decision-makers when to produce, consume, or hold stocks, and, in a sense, regulate production and consumption of the commodity [32, p. 46]. Accordingly, futures prices should also act to stabilize current cash price series. Smyth shows that prices resulting from production plans based on public price forecasts will be more stable than prices generated through reliance on past prices to guide production plans. If one views futures prices as forward prices, the same result should hold if producers or other members of the industry use these prices in determining production plans. In essence, as forward prices are translated into more orderly transformations of market positions, a "dampening of intraseasonal and interseasonal prices movements" can be expected [14, p. 36].

In theory, at least, futures trading should have a stabilizing impact on cash markets; nevertheless, empirical verification is inconclusive. For example, both Working and

Gray found reduced price variability in the U.S. onion market after futures trading had been initiated [50, 16]. But a U.S. Department of Agriculture study of the onion market found that futures trading had little or no effect on the variability of onion prices [25].* Powers investigated the impact of futures trading on price fluctuations in the pork bellies market and demonstrated a dampening on the random element of the short-term cash price series [34]. This result cannot be readily translated into a reduction of the overall variance in the price series unless it is assumed that the random element accounts for a large portion of the variation in the actual cash prices. Unfortunately, however, that assumption does not appear to be justified.

Peck' empirical tests of her hypothesis that producer supply response should increase with futures trading in a commodity are not conclusive [32]. Although a shift in producer supply response did occur after futures trading in onions was initiated and again after it was halted, she could not establish a cause and effect relationship between these events. Some other structural shift may have occured for which her model did not account.

The empirical analysis of the impact of futures trading on the responsiveness of plywood supply to price signals, described in Appendix E, shows that with a futures market a given change in price would result in a larger change in the quantity of plywood produced. That is, the responsiveness of supply to price increased after futures trading in plywood was initiated.

There are some who argue that the speculative activity in futures markets has a destabilizing effect on cash prices. Although the empirical evidence is not all in, such a viewpoint does not seem justifiable. Speculators form expectations of current and future prices of a commodity. When prices generated in the market (cash or futures) deviate from these expectations sufficiently to create expected profits for traders, some traders will enter the market in hopes of profiting from the price change. Thus, if speculative expectations are based on the best available market information, speculators act to stabilize prices at their true value.

If, however, speculators base their price expectations on the actions of other speculators, speculative trading may, indeed, have a destabilizing effect on prices. In futures markets, this type of speculative behavior is termed "movement trading." Price levels resulting from movement trading can deviate significantly from those that would be generated by a rational assessment of present and future market conditions. Empirical research has shown, though, that most commodity futures markets do not exhibit evidence of significant movement trading.* Furthermore, currently accepted theories concerning hedging in futures markets assign speculators a major role in assuring well functioning futures markets. Speculators enter a market in response to hedging demand, adding necessary liquidity to the market. In addition, it has been suggested that speculation above that required by hedging tended to reduce price distortion in the frozen orange juice concentrate futures market [48].

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*The different conclusions based on the same basic methodology can be explained, at least in part, by the availability to Johnson of other, more extensive, futures trading data. See Johnson's discussion in [25, pp. 34-41].

Market Information Effects of Futures Trading

Closely allied with the pricing function of futures trading is the market information function. Information originates from a variety of sources. Exchanges regularly publish and make available statistics on trading volume, price, and the open interest for the commodities traded on their floors. Commission houses publish supply and demand estimates and make price forecasts available to their customers. Traders use this information, as well as information from other sources, such as government agencies, in forming expectations concerning future market conditions. This information is reflected in the futures prices generated on the exchange and, in this sense, futures markets act to assimilate and disseminate market information. Futures prices are quoted on a daily basis in most major newspapers and are therefore readily available to all market participants, whether or not they trade in futures. We have already pointed out that these prices are used in formulating production, consumption, and inventory decisions.

To an extent, all markets act as information-gathering and -assimilating points. The ability of a futures market to increase the normal flow of market information results from: (1) providing a central marketing place; (2) increasing the number of traders in the market (thereby increasing the competitiveness of the market); and (3) lowering the transaction costs of information exchange.

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*Significant movement trading in a commodity traded on a futures market would be evidenced by serial dependence of the futures prices generated for that commodity. Several studies have performed time series analysis on futures prices, and, while it is beyond the scope of this paper to describe the studies or their results, in general, only minor distortions from serially independent prices have been found. The interested reader is referred to [26, 36, 7].

In general, the increased flow of market information from futures trading leads to better informed market participants and a more responsive marketplace. As a result, "market prices provide more accurate signals for resource allocation when there is futures trading in a commodity" [11, p. 1235].

The Risk Management Function of Futures Markets

Commerical buyers and sellers of commodities traded on futures markets, or of closely related commodities, are able to manage or reduce the risk of volatile cash prices by hedging in futures markets. As mentioned earlier, a hedge consists of taking an opposite position in the futures market from one held in the cash market. The key to the hedging role of futures trading is that near futures prices and the cash price of a given commodity tend to move together, since they are influenced by the same demand and supply information. Thus, by taking opposite positions in the cash and futures market, a loss in one market can be offset by a gain in the other. Any commodity can be traded against any futures contract as long as the prices for the commodity and the futures contract are highly correlated. Copper scrap, for example, is not traded on any organized commodity exchange, but purchases and sales of copper scrap can be successfully hedged against either the copper futures contract traded in New York or that traded in London. This is so because the price of copper scrap is highly correlated with the cash price of refined copper which, in turn, is correlated with the nearest copper futures contract price, as shown in Figure 4. The effectiveness of the hedge depends on the degree of correlation between the futures and cash prices.

For the purposes of this study, two basic types of hedging activities will be outlined: the buying hedge and the selling hedge. In essence, a buying hedge involves the purchase of futures contracts, and a selling hedge the sale of futures contracts. Depending on the circumstances, both are useful to commercial producers, consumers, and merchandisers of the given commodity.

A trader uses a buying hedge when he is interested in establishing a forward price for a planned or actual commitment in the cash market. For example, a copper scrap dealer, who has no stock on hand, may be offered what appears to be a profitable price for some scrap. By entering into this forward contract, he risks a rise in the cost of the copper scrap he will buy for fulfillment of the formal contract. Since, as previously shown, copper scrap prices are correlated with current month copper futures prices, he can protect himself from a rise in the cash price by purchasing an equivalent amount of copper futures.

Table 5 illustrates a hypothetical buying hedge. In April,

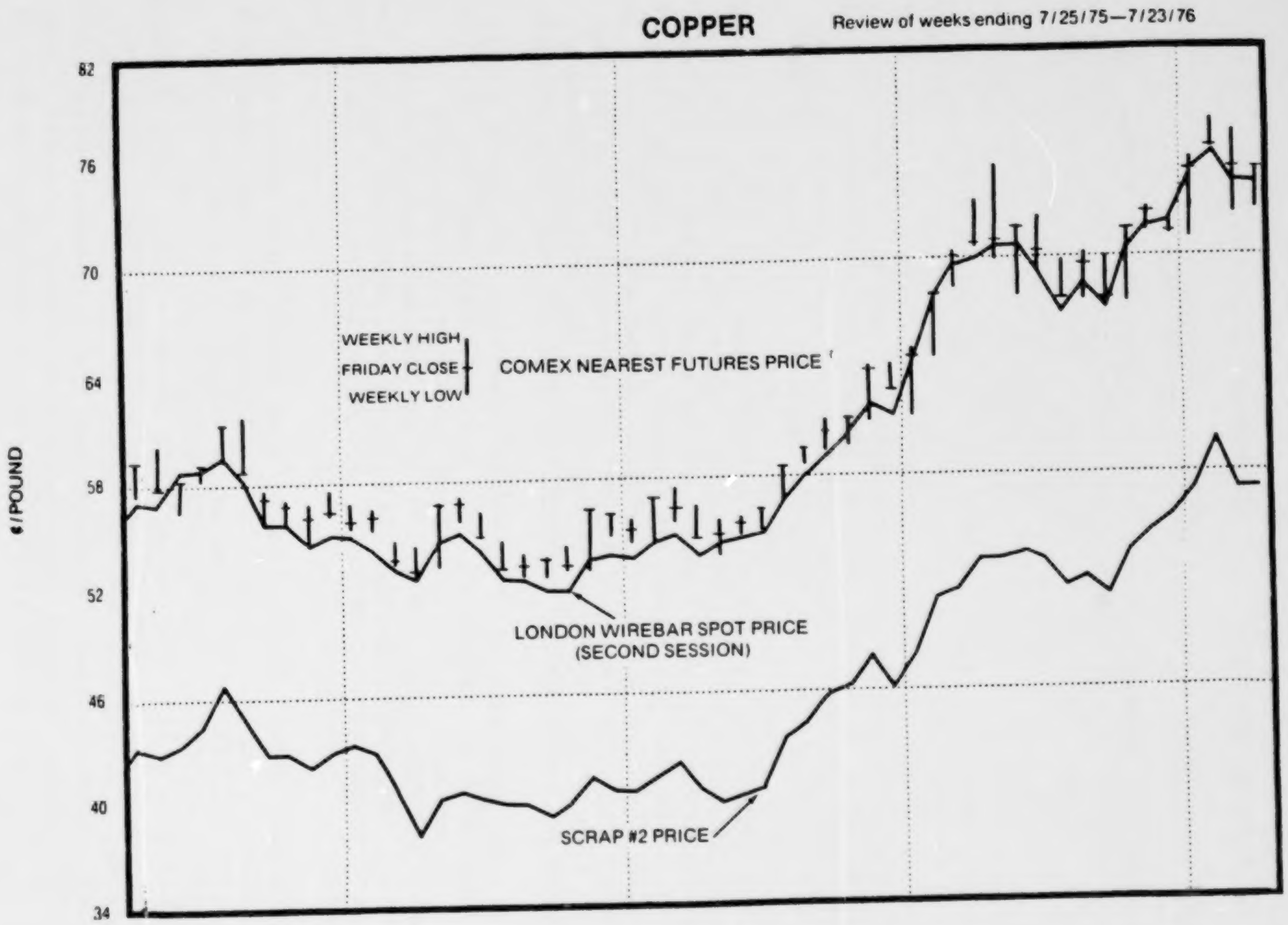

Figure 4. Copper prices: futures, wirebar, and #2 scrap

the scrap dealer contracts to provide 25,000 pounds of # 2 copper scrap in two months at 48.5¢ per pound. At the same time, he purchases one July copper futures contract that is currently trading for 64.2¢ per pound. In June, he has an opportunity to buy the needed scrap, but the price has risen to 50.5¢ per pound for a loss of 2¢ on his contract transaction. During this period, the copper futures contract should also have risen in price, thus enabling the dealer to offset the 2¢ loss by selling his futures contract for 2¢ more than what he paid for it. His net loss would be zero.

A selling hedge enables a commercial trader to protect previous purchases from a price decline, in other words, to protect inventory holdings. For instance, if a copper scrap dealer has accumulated a certain quantity of scrap in his yard in anticipation of a rise in the cash price of the scrap during the period in which he holds the inventory, he can protect himself from an adverse change in the cash price by selling copper futures.

Table 6 outlines a hypothetical selling hedge. In April, the dealer buys 25,000 pounds of # 2 copper scrap at 48.5¢ per pound and sells a July copper futures contract at 64.2¢ per pound. The cash price of the scrap drops to 46.5¢ by June, and he decides to sell his inventory at a loss of 2¢ per pound. At the same time, he buys back the futures contract at 2¢ less than what he paid for it. Again, the net loss is zero.

TABLE 5. EXAMPLE OF A BUYING HEDGE

Activity	Cash	Futures
April:		
Buy	---	July 64.2¢
Sell	48.5¢	---
June:		
Buy	50.5¢	---
Sell*	---	July 66.2¢

*Loss, 2.00¢; gain, 2.00¢; net loss, 0.

TABLE 6. EXAMPLE OF A SELLING HEDGE

Activity	Cash	Futures
April:		
Buy	48.5¢	---
Sell	---	July 64.2¢
June:		
Buy	46.5¢	July 62.2¢
Sell*	---	---

*Loss, 2.00¢; gain, 2.00¢; net loss, 0.

A few caveats are in order, however, with respect to the hypothetical situations presented in Tables 5 and 6 as discussed above. First, the descriptions of buying and selling hedges are extremely simplified. Normally, the decision on whether to hedge will depend on a host of factors, including the basis at which the hedge can be established and the trader's expectations of the most likely outcomes;* rarely will a hedger routinely hedge his cash market transactions. Furthermore, hedges will almost never exactly offset the gain or loss in the cash market transaction; most prices are not perfectly correlated.

All the same, these cautions should not obscure the importance of the hedging role of futures markets. Through a rational hedging program, commerical buyers and sellers can manage the risk of cash price movements that may affect their cash market position. Where risk is defined as variance in income, futures markets act to stabilize producer and consumer income. By offsetting losses and gains in the cash market through appropriate hedging plans, vagaries in income can be lessened.

A futures market is generally most effective in stabilizing income when income variability results mainly from price fluctuation [31]. Routine hedging on the basis of expected output can cause greater income instability if the main source of uncertainty is output variation.* Generally, if the variation in the basis is less than the cash price variation, returns will be more stable when positions are hedged in a futures market, assuming hedges can be placed over a sufficiently long period to cover the period of price instability.

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*The basis is defined as the difference between the cash price of a commodity and the near futures price.

SUMMARY

In summary, two points should be emphasized. First, a well functioning futures market increases the quantity and quality of market information available to participants in the cash market. This, along with the price discovery role of futures markets, decreases uncertainty in the marketplace. Second, futures markets provide a mechanism for managing, through hedging, the remaining price uncertainty.

The discussion in Section 3 regarding uncertainty and resource allocation in the secondary materials markets raises two questions. First, is a futures market in secondary materials feasible? Second, what would be the possible impacts of a scrap futures market on secondary markets? Sections 5 and 7 will address these questions.

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*For example, imagine a wheat farmer who, on the basis of an expected yield of 15,000 bushels from his acreage, sells three 5,000-bushel futures contracts at the beginning of the crop year at $2.50 per bushel. At harvest time, the farmer finds that the price of wheat has risen to $3.00 per bushel, but because of a major drought during the crop year he is only able to harvest 5,000 bushels. He has to buy back his futures contracts at $.50 more than he paid for them, for a loss of $7,500. His gain from the price of wheat rising is only $2,500. He would have been better off not hedging at all. Although simplistic in nature, this problem is common for many producers of agricultural crops where output uncertainty because of weather is of major proportions.

SECTION 5

FUTURES TRADING IN SECONDARY MATERIALS

Of the hundreds of commodities that are bought and sold daily, only about 35 are actually traded on foreign and U.S. commodity exchanges. The various criteria used to judge whether a commodity can be successfully traded are vague; furthermore, there is little consensus among commodity specialists as to their relative importance. Consequently, even after conducting extensive research, an exchange will frequently base its decision on whether to trade a commodity on instinct.

Nevertheless, it is possible to identify, based on a review of the relevant literature and conversations with commodity specialists, some elements that affect a commodity's ability to be successfully traded on a futures market. The broad criteria that are considered important for a successful futures market in a commodity will be presented first. An evaluation of specific characteristics of wastepaper and ferrous scrap markets, in light of the general and more specific criteria, will follow.

GENERAL ELEMENTS NECESSARY FOR SUCCESSFUL FUTURES TRADING

It is essential for successful futures trading that a hedging need exist within the industry. In other words, "there must be a reason for commercial buyers and sellers of the commodity to want to substitute futures contracts temporarily for merchandising contracts" [17, p. 122]. This implies that there must be sufficient variation in the cash price to make buyers and sellers want to use a mechanism to "insure" against price risk. Once hedging demand has been assured, it is necessary to attract speculation to take up the long side, or buyers' side, of the market; speculators are usually attracted to markets with large hedging volume and fluctuating price.* Closely tied to the above concepts is the necessity of designing standard contract terms, quality, storage, delivery requirements, etc., that follow accepted industry practice.

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*In futures markets, short hedging usually exceeds long hedging. The reasons for this are complicated and not particularly germane to this paper. The interested reader is referred to [14, p. 27].

Furthermore, there must be a general industry acceptance of the futures market. Ignorance concerning the functions of futures markets, ill-informed or misconceived notions regarding futures trading, and possible fears of losing market control may cause industry to shun the market, and result in a possible lack of trading volume.

The general elements of a successful futures contract, discussed above, are interdependent. Industry acceptance of a futures market is determined in part by its perceptions of hedging needs and in part by an exchange's ability to design a standard contract that follows accepted industry procedures, does not bias the futures prices, and overcomes regional marketing differences. The importance of these interdependencies will become more apparent later in this discussion.

It is clear that a need exists in the wastepaper and ferrous scrap markets for some mechanism to manage price risk and to reduce the impact of uncertainty in the marketplace. Despite general agreement among scrap industry members concerning the need for some mechanism to cope with uncertainty in the marketplace, there is some doubt among participants in the scrap industries that futures markets represent a practical, or even desirable, alternative. These doubts typically result from an incomplete understanding of futures markets and their operation. Common fears are that futures markets would supersede the normal marketing procedures for scrap, and that speculators would enter the market and drain industry members of their profits.

The next subsection will discuss the specific criteria for successful futures trading and their applicability to the secondary materials markets. The purpose is to isolate the important considerations, rather than to propose solutions. The solutions must come from interaction between an exchange and the industry. Further on, a potential role for the government in this process will be presented.

SPECIFIC ELEMENTS OF SUCCESSFUL FUTURES TRADING

The general elements of successful futures trading discussed above suggest, in turn, several specific elements vital to successful wastepaper and scrap steel futures contracts. These are presented below.

(1) The existence of a competitive marketplace (many buyers and sellers) is an important consideration, partly to insure sufficient trading volume and partly to insure that one side of the market is unable to control the entire market.

If there were many sellers but only a few buyers, the buyers would be able to influence the futures price. In that situation, the sellers would soon recognize the buyers' advantageous position, and would no longer participate in the market. The reverse would occur if buyers, rather than sellers, dominated the market.

Measuring the competitiveness of an industry generally requires some knowledge of the structure, conduct, and performance of the firms in that industry [10]. In the event that complete information on these matters is unavailable, the concentration ratio is a useful substitute means of evaluating an industry's competitiveness. Concentration ratios typically show the percent of the total value of shipments accounted for by the largest 4, 8, and 20 firms in an industry. Table 7 lists the four-firm concentration ratio for different sectors of the steel and pulp and paper industries for 1967 and 1972.

Based on the 1967 data, Guthrie concludes that the pulp and paper industry is relatively competitive. His conclusion was based on the fact that all but two sectors, pulp and sanitary products, had ratios of less than 30; he considered a concentration ratio of less than 30 for the four largest firms to be fairly low, "since economies of scale in the production of most paper and paper products are substantial" [20, p. 192]. The addition of the 1972 data does not affect this conclusion. Although there are some slight changes, all sectors but pulp and sanitary products indicate relatively competitive market conditions.

If this same criterion is applied to the concentration ratios for different sectors of the steel industry, the same conclusion holds; all but one sector, the blast furnaces and steel mills, have ratios of close to or less than 30. The 1972 ratio for blast furnaces is 45, high in comparison with the other ratios; however, it is probably a poor indicator of the competitivenss in that sector of the market with respect to purchases of scrap materials, since it does not account for foreign competition for scrap.

Although no concentration ratios are available for the seller or scrap dealer side of the markets for wastepaper and ferrous scrap, it appears that this sector fits very well into the competitive mold. There are approximately 1,800 firms in the basic U.S. ferrous scrap industry, most of which are small, family-run operations (over 80 percent of the firms have annual output volumes of less than 30,000 tons) [35, pp. 179-81]. The dealer side of the wastepaper market is much the same; in 1963, there were 2,711 wastepaper dealers in the United States [12, p. 41]. Of 109 respondents to a survey by Battelle, 61 firms handled less than 50,000 tons of wastepaper in 1969, and only 12 handled over 200,000 tons [5, p. 108]. Furthermore, most

TABLE 7. CONCENTRATION RATIOS FOR SELECTED SECTORS OF THE PULP AND PAPER, AND STEEL INDUSTRIES (4-FIRM RATIOS)*

Item	1967	1972
I. Paper and Pulp:		
Pulp Mills	45	59
Paper Mills	26	24
Paperboard Mills	27	29
Sanitary Products	63	63
Folding Boxes	22	28
Set-up Boxes	12	11
Corrugated and Solid Fiber Boxes	18	18
II. Steel:		
Blast Furnaces and Steel Mills	48	45
Steel Pipes and Tubes	26	23
Grey Iron Foundries	27	34
Steel Foundries	NA	24
Steel Wire and Related Products	24	18

*Source: U.S. Department of Commerce, Bureau of the Census, Census of Manufacturing, 1967 and 1972.

dealers are located near a few major cities, and competition is, therefore, intense.

On the whole, the ferrous scrap industries and wastepaper industries are relatively competitive. It is doubtful that one side of the market could exert control over the other, should futures markets be initiated in either commodity.

(2) The difficulty in defining a standard contract for trading may be the most formidable barrier to successful futures trading in scrap materials. Two specific concerns

stand out: the definition of a standard contract grade; and the definition of standard pricing and delivery arrangements. These are discussed below.

Standard Contract Grade

As mentioned earlier, a futures contract calls for delivery of a standard grade of a commodity. This grade must be specified within small tolerances, whose delineation must be acceptable to members of the industry. Furthermore, this grade should represent a sizable portion of the commercial transactions in the cash market for the particular commodity, to assure that there will be potential buyers to take delivery on the contract, as well as sellers to make delivery.

Very few commodities are a single, standard grade. Wheat, for example, is not simply wheat--it is red wheat, winter wheat No. 1 or No. 2, and so on. Even within a grade there are differences in protein content due to differences in seasonal growing conditions. What is important is that these grades are standardized, and can be distinguished by sight, touch, chemical analysis, or other means. A futures contract, using these physical characteristics, defines a specific grade for delivery. Each contract in a commodity specifies the same delivery grade.* In this sense, the contract is homogeneous [46, p. 274]. At least in the case of a single contract grade, each buyer knows exactly the grade and quality of the commodity that will be delivered if he decides to take delivery.

Critics of futures trading in scrap argue that the heterogeneity of wastepaper and iron and steel scrap preclude successful futures trading in those materials. In addition, they argue that because different grades of wastepaper and ferrous scrap do not always substitute for one another in production processes, a grade that is useful for one type of mill may be useless to another. In the United States, trade associations for these two industries publish suggested standards for particular grades of scrap. While these standards carry no legal weight, they do serve as guidelines for buyers and sellers of scrap.

There is an apparent consensus among industry members knowledgeable of futures markets and commodity exchange officials that the present specification guidelines for ferrous scrap are not sufficiently rigorous to be used in designing a futures contract. Grade specification, at least on the buying side of the market, appears to be mostly a function of the product for which the scrap will be used as an input. This is not an insurmountable problem, but it does require that scrap buyers, sellers, and exchange officials meet and outline formal, concise tolerances in terms of allowable contaminant levels, and formulate descriptions for at least the major grade of scrap.*

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*In practice, there are contracts that allow other grades to be delivered in lieu of the par grade, but with associated premiums and discounts based on its value relative to the par grade.

For two reasons, No. 1 Heavy Melting and No. 1 Bundles seem to be appropriate grades for a ferrous scrap futures contract. First, they are relatively homogeneous. They are derived from a few known sources and have a history of use in the industry. Buyer confidence in both No. 1 Heavy Melting and No. 1 Bundles is great. Second, both grades account for a large portion of the commercial transactions in ferrous scrap; together, these two grades constituted 32 percent of all purchased scrap receipts in 1975 [24, p. 7].

The published specification guidelines for wastepaper, like those for ferrous scrap, are too lax for futures trading. The choice of the particular grade for trading, though, is confused somewhat by the lack of data concerning industry-wide purchases of specific grades of wastepaper. The available data detail consumption of wastepaper only by broad grade classification (e.g., Mixed Papers, Newspapers). Using these data, corrugated materials would be the general class of wastepaper from which a delivery grade should be chosen (in 1976, corrugated materials accounted for 41 percent of all wastepaper consumed in the manufacture of paper and paperboard).** Of the six or seven different grades of corrugated materials, one that is of high quality and that constitutes a significant portion of the commercial transactions in corrugated wastepaper would have to be chosen.

It is suggested, at least for initial trading, that a futures contract in ferrous scrap or wastepaper be confined to one grade. Otherwise, buyers who can use only the par grade in their production processes might be hesitant to take delivery on the futures market for fear of receiving the non-par grade. This does not mean that such a contract would be of use only to those buyers and sellers who deal in the particular grade traded. As long as the prices for different grades of ferrous scrap and of wastepaper move together closely, the contract can be used to hedge commercial transactions in other scrap grades; the trader need never consider making or taking delivery on the market.

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* It is important to note that only the grade or grades to be used as contract grades need to be respecified; they are the only ones that will be delivered on the futures market.

**American Paper Institute, 1976-1979 Capacity: Paper, Paperboard, Woodpulp Fibre Consumption (New York: American Paper Institute, 1977).

Appendix B shows the results of statistical tests performed on the price series for individual grades of ferrous scrap and wastepaper. The individual grades of ferrous scrap are highly correlated; thus, a futures contract in No. 1 Heavy Melting could be used to hedge market transactions in other grades. There is less correlation among wastepaper prices. Consequently, it is unlikely that a one-grade wastepaper contract could serve as a guide for hedging activities in other grades of wastepaper.

Because prices for various wastepaper grades are not closely correlated, it could be argued that trading in separate contracts for each grade should be instituted. Although feasible, several different contracts in wastepaper could reduce the potential number of buyers and sellers in any one contract, and thus impair the liquidity of the market.

Standard Pricing and Delivery Arrangements

As stated earlier, a futures market is not a delivery market. Typically, only a small fraction of the total volume of contracts traded are satisfied by delivery. Even though delivery is relatively uncommon, a futures market requires that delivery can take place. In essence, it is the threat of delivery on a futures contract that forces the basis toward zero during the delivery month. It is this tendency for the cash price to equal the futures price in the month of delivery that enables futures markets to be used as an effective hedging device. If, for example, the cash price during the delivery month significantly exceeds the futures price, holders of futures contracts will take delivery of the commodity on the futures market and sell in the cash market. The increased current cash market supply causes the cash price to fall to the level of the futures price. Thus, terms that insure delivery on the contract are essential elements of a successful futures contract. Terms that complicate delivery also increase the cost of delivery, and cause hedgers to be reluctant to make or take delivery on a contract.

Futures markets traditionally use one of two types of pricing arrangements: (1) delivered to the market city; or (2) F.O.B. a natural shipping point. The choice of system depends upon which side of the cash market normally assumes responsibility for transportation charges. If it is the buyer, then F.O.B. shipping point would be the appropriate choice; if it is the seller, pre-paid to market city should be chosen.

In the case of wastepaper, the election of method is complicated by the lack of a standard industry procedure relating to pricing arrangements. Normally, the assumption of transportation charges is determined by the specific agreement between the buyer and the seller. Many of the agreements are F.O.B. shipping point, with the buyer assuming the transportation charges [5, p. 48]. This procedure seems to be used primarily for short-distance transactions, where both the scrap and the scrap dealer are located in or near the same market city. Longer-distance hauls may be priced pre-paid to destination.

Ferrous scrap transactions are apparently more standardized --the seller almost always pays the transportation charges. Because this method is normally employed for most ferrous scrap transactions and for the higher quality grades of wastepaper, its use is recommended for ferrous scrap and wastepaper futures contracts.

Once the appropriate pricing arrangement has been chosen, it is necessary to choose the base point from which the prices will be established. This base point usually also refers to the area or market city from which and to which delivery is made on a futures contract. For example, wheat traded on the Chicago Board of Trade is priced delivered to Chicago, the natural marketing point for that commodity. Plywood, on the other hand, is priced F.O.B. Portland, Oregon, since that area of the Northwest contains a heavy concentration of plywood sellers.

There are four criteria considered important in selecting a base point [29, p. 7].

(1) There should be only one base pricing or delivery point. Otherwise, a buyer of a futures contract may be uncertain of the point of origin of his purchase, and this uncertainty may reduce market liquidity.

(2) The base point should be a natural merchandising channel for the commodity in question. In other words, the base point city or area should be one where the commodity is consumed, stored, and passes through under normal business transactions.

(3) To provide a point for creating an average price, the base point should be a natural loading point for shippers in the industry.

(4) Storage and/or production facilities should exist so that physical delivery can be made at a known cost.

Although in the strictest sense no central marketing place exists for wastepaper and ferrous scrap, the market for these commodities is highly concentrated. Figure 5 shows the location of wastepaper dealers in the United States. Wastepaper buyers and sellers are concentrated primarily between Philadelphia and Boston, with another large market in Chicago. Figure 6 shows the large intraregional movement of wastepaper within the area loosely bounded by those cities. Any one of the large cities within this area could be used as the base point; it has been suggested that New York would be appropriate, since this area already accounts for a large portion of the commercial transactions in wastepaper.

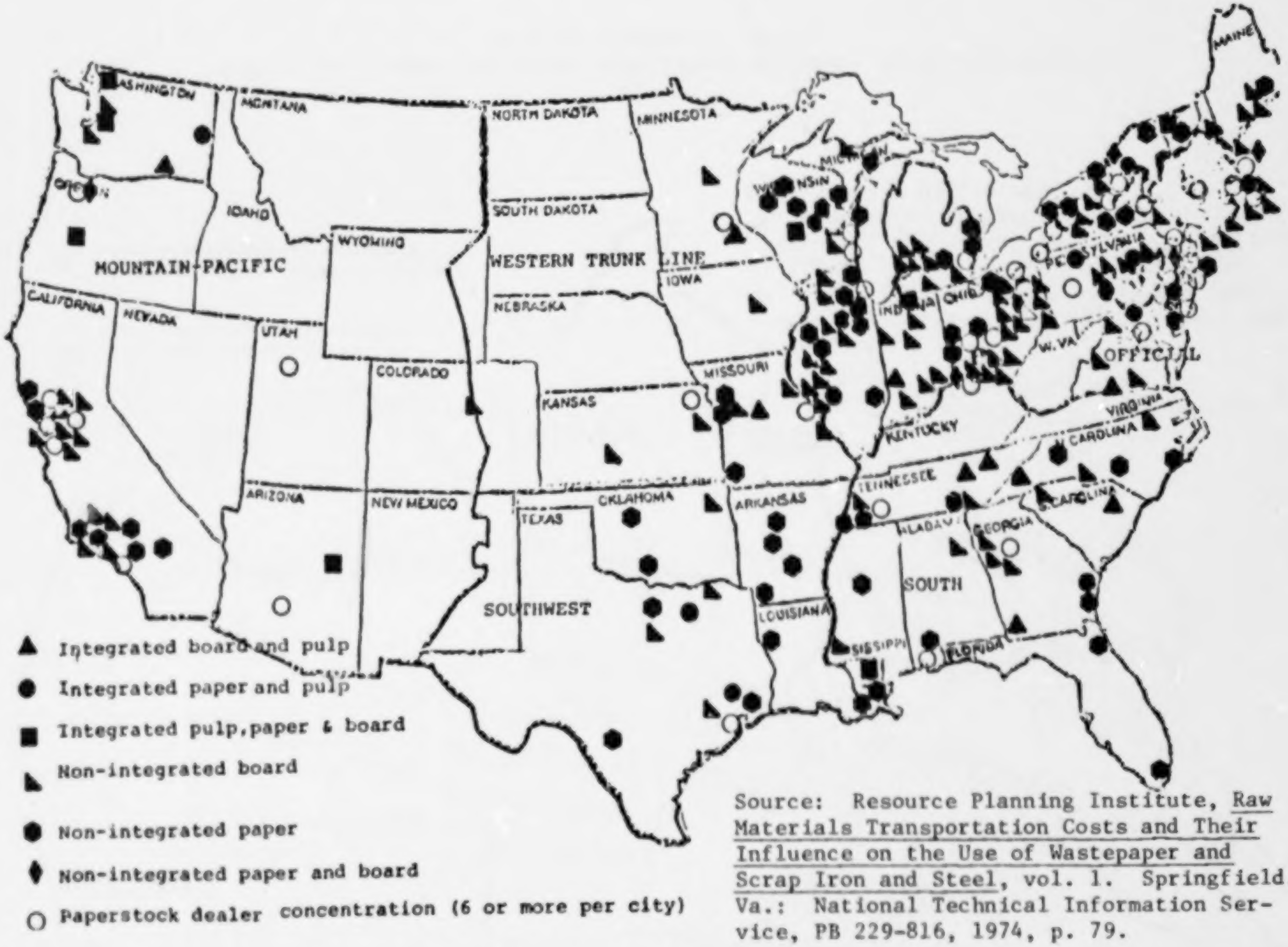
Ferrous scrap dealers and users (see Figures 7 and 8) are located mainly between Chicago and Philadelphia, with heavy concentrations in and around Pittsburgh. Because of the large volume of ferrous scrap movement within this region (see Figure 9), Pittsburgh would be a likely candidate for a base point for pricing and delivery.

In conclusion, although no central marketing place for ferrous scrap or wastepaper exists, the markets for these commodities are sufficiently concentrated so that one city within the regions mentioned above could serve as a base point for pricing and delivery. There are enough buyers and sellers within the areas who normally take and receive shipment of scrap to insure that delivery could take place on a scrap futures contract.

There are two different instruments for initiating delivery of a commodity on a futures market, the warehouse receipt and the shipping certificate. Both are certificates of title transfer. The warehouse receipt is traditionally used to transfer title to a commodity traded on a futures market. It says, in effect, that the seller will ship the commodity to the buyer from an exchange-owned and -regulated warehouse in which he stores the commodity. In essence, the warehouse receipt signifies delivery from inventory or storage. The shipping certificate, on the other hand, is used for commodities for which only small inventories are held (e.g., plywood, live cattle, porkbellies). It calls for delivery from current production.

Only those sellers that an exchange has declared "regular" for delivery can issue delivery instruments. A seller becomes "regular" by submitting to a check of its integrity (both financial and otherwise) by the clearinghouse, and by agreeing to abide by the rules and regulations of the exchange.

The shipping certificate would be the appropriate delivery instrument for scrap futures, since inventories of ferrous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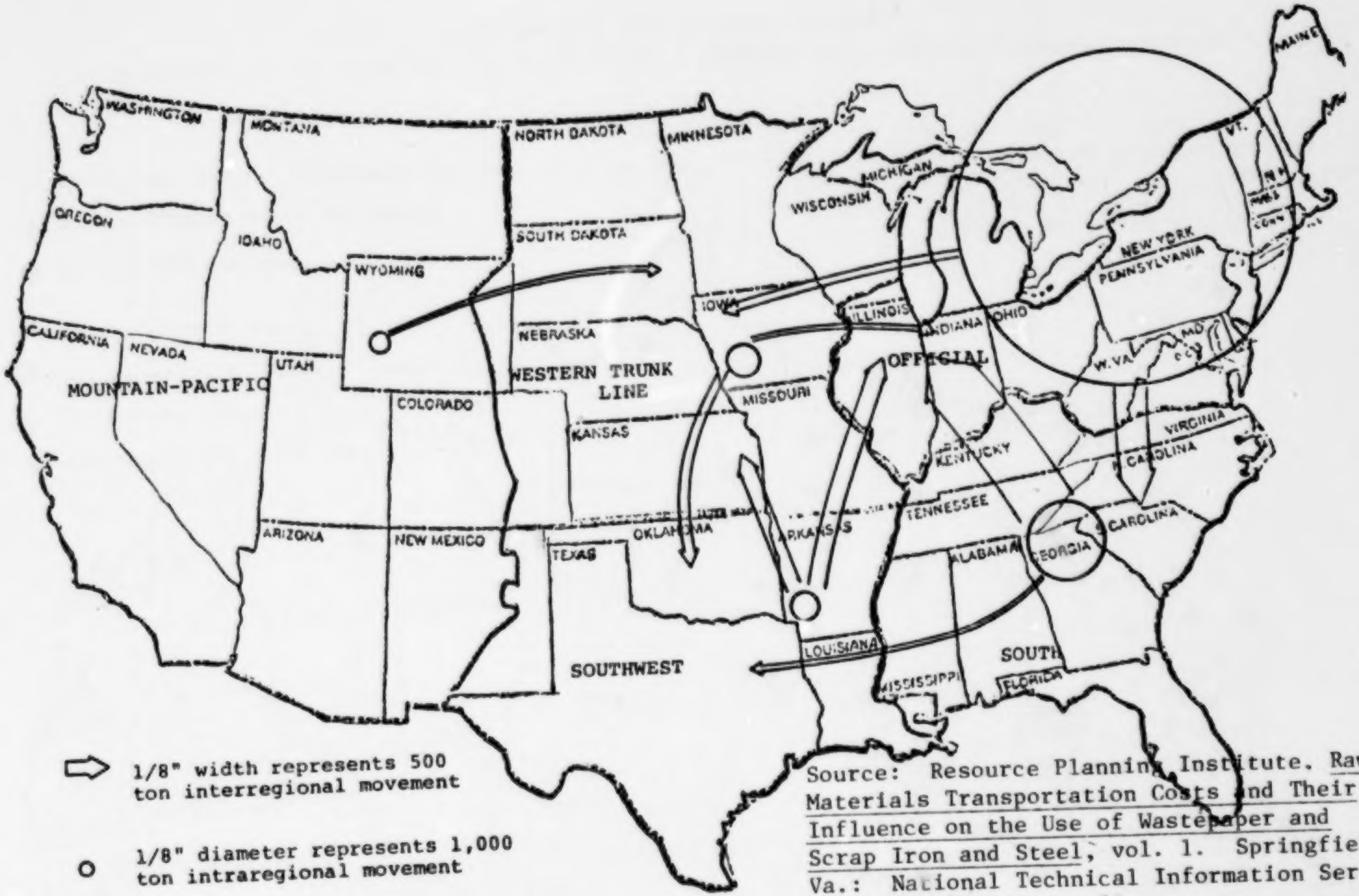
WESTERN TRUNK LINE
IOWA
PENNSYLVANIA
NEBRASKA
CALIFORNIA
NEVADA
UTAH
INDIANA
OHIO
W. VA
OFFICIAL
COLORADO
MISSOURI
KANSAS
VIRGINIA
KENTUCKY
N. CAROLINA
TENNESSEE
ARIZONA
NEW MEXICO
OKLAHOMA
ARKANSAS
S. CAROLINA
TEXAS
ALABAMA
GEORGIA
SOUTH
SOUTHWEST
LOUISIANA
MISSISSIPPI
FLORIDA
▲ Integrated board and pulp
● Integrated paper and pulp
■ Integrated pulp, paper & board
◣ Non-integrated board
⬢ Non-integrated paper
♦ Non-integrated paper and board
○ Paperstock dealer concentration (6 or more per city)

Source: Resource Planning Institute, Raw Materials Transportation Costs and Their Influence on the Use of Wastepaper and Scrap Iron and Steel, vol. 1. Springfield, Va.: National Technical Information Service, PB 229-816, 1974, p. 79.

Figure 5. Locations of paperstock dealer and broker concentrations and major paperstock users.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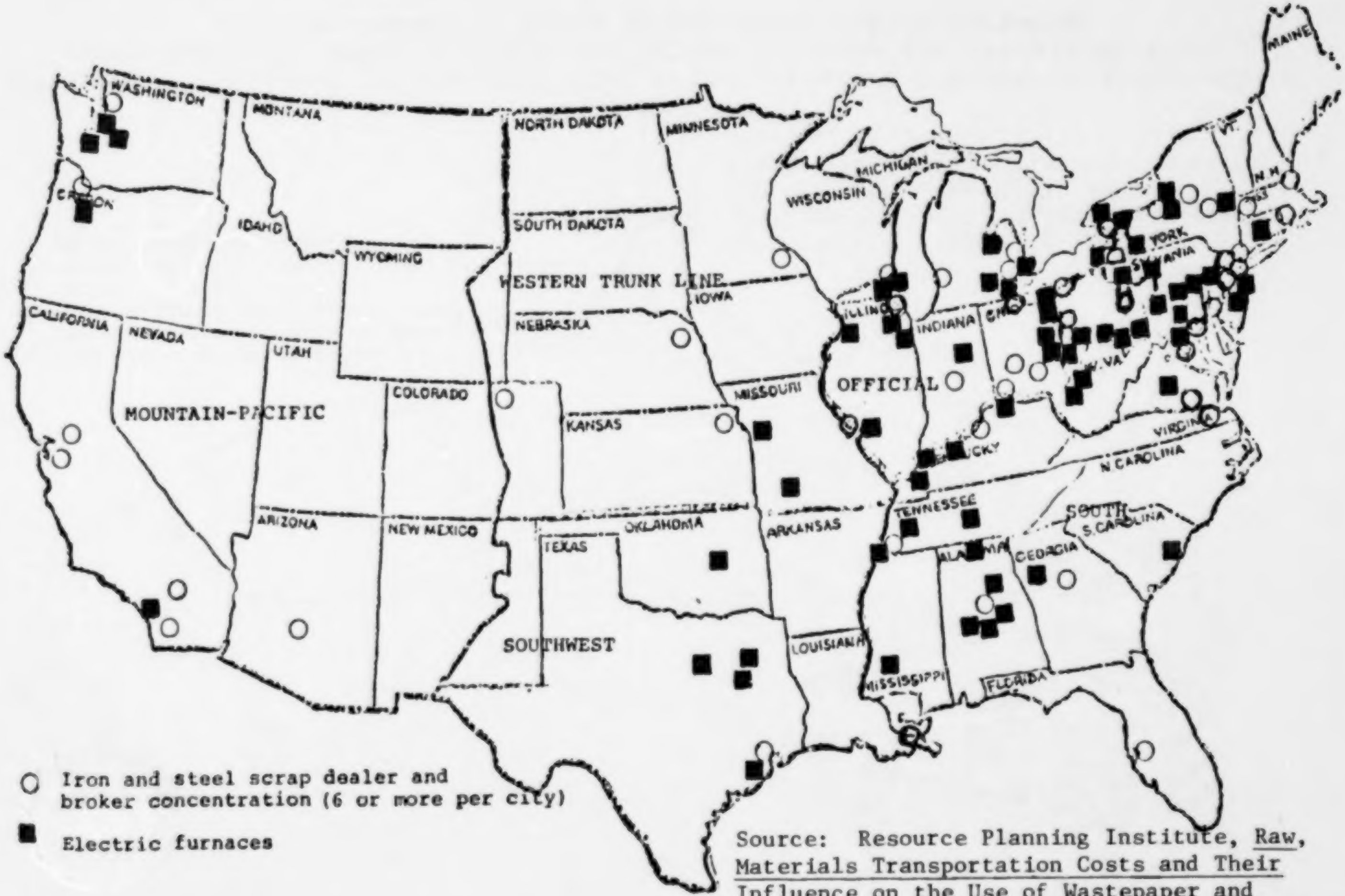
TEXAS
OKLAHOMA
ARKANSAS
ALABAMA
GEORGIA
CAROLINA
LOUISIANA
SOUTH
SOUTHWEST
MISSISSIPPI
FLORIDA
⇨ 1/8" width represents 500 ton interregional movement
○ 1/8" diameter represents 1,000 ton intraregional movement

Source: Resource Planning Institute. Raw Materials Transportation Costs and Their Influence on the Use of Wastepaper and Scrap Iron and Steel, vol. 1. Springfield, Va.: National Technical Information Service, PB 229-816, p. 91.

Figure 6. Interregional and intraregional rail movements of wastepaper - 1969.


○ Iron and steel scrap dealer and broker concentration (6 or more per city)
■ Electric furnaces
WASHINGTON
MONTANA
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MINNESOTA
MICHIGAN
WISCONSIN
MAINE
VT.
N.H.
OREGON
IDAHO
SOUTH DAKOTA
WYOMING
WESTERN TRUNK LINE
IOWA
NEW YORK
PENNSYLVANIA
CALIFORNIA
NEVADA
UTAH
NEBRASKA
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INDIANA
OHIO
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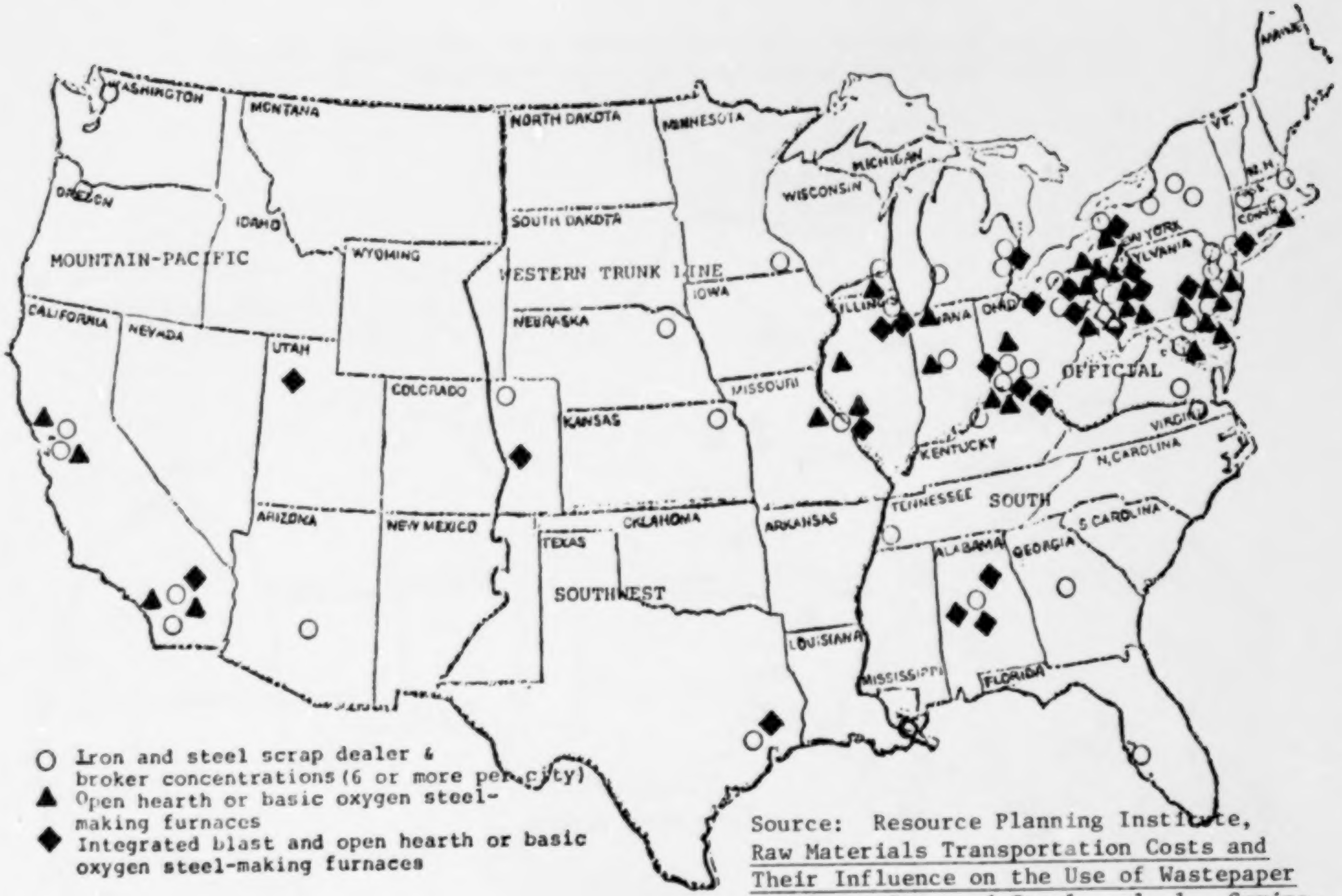
NEW MEXICO
OKLAHOMA
TEXAS
ARKANSAS
TENNESSEE
SOUTH
S.CAROLINA
ALABAMA
GEORGIA
SOUTHWEST
LOUISIANA
MISSISSIPPI
FLORIDA

Source: Resource Planning Institute, Raw, Materials Transportation Costs and Their Influence on the Use of Wastepaper and Scrap Iron and Steel, vol. 1. Springfield, Va.: National Technical Information Service, PB 229-816, 1974, p. 43.

Figure 7. Locations of iron and steel scrap dealers and broker concentrations and electric steel-making furnaces.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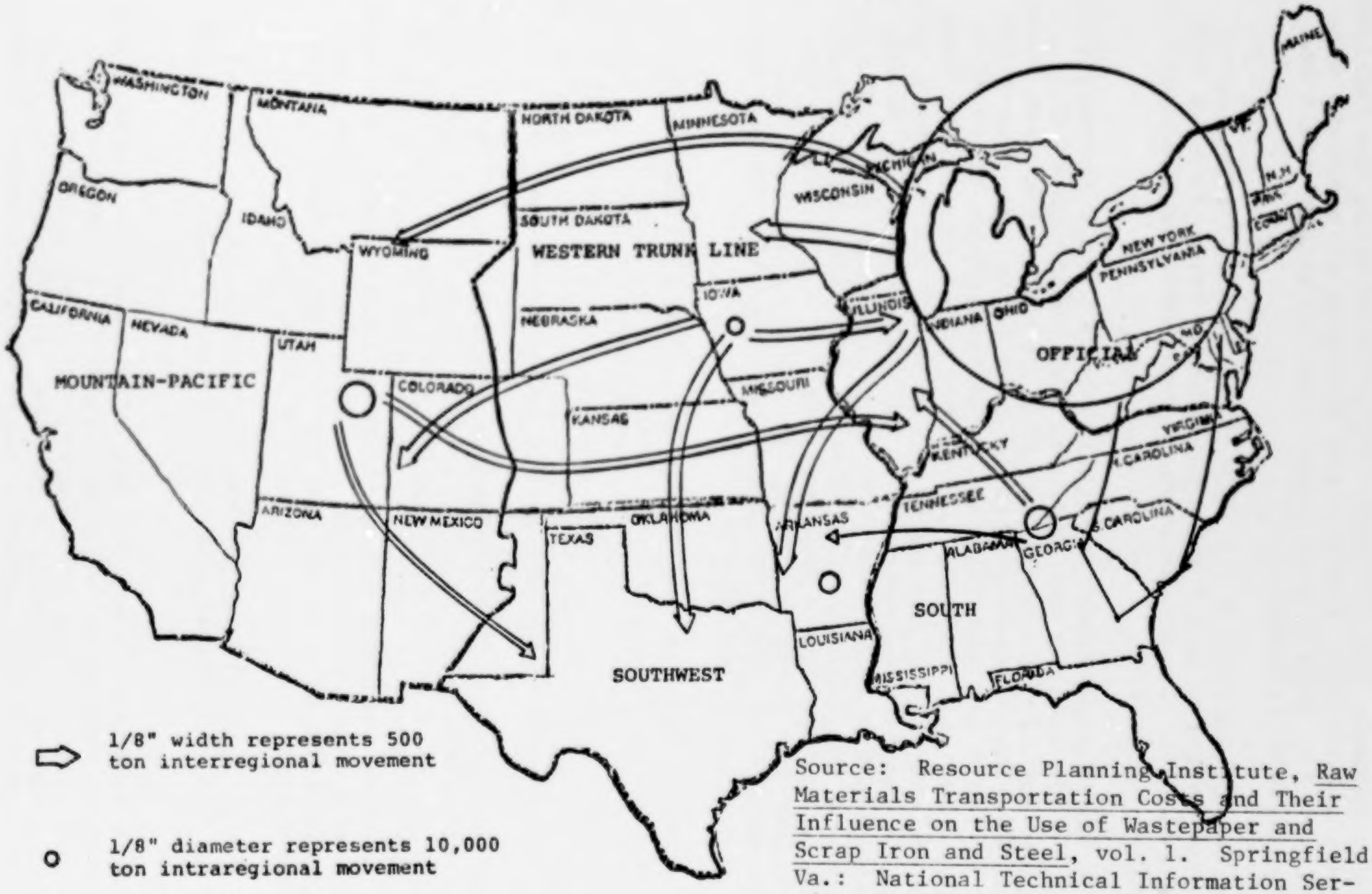
CONN.
MAINE
MOUNTAIN-PACIFIC
WESTERN TRUNK LINE
SOUTHWEST
SOUTH
OFFICIAL
○ Iron and steel scrap dealer & broker concentrations (6 or more per city)
▲ Open hearth or basic oxygen steel-making furnaces
◆ Integrated blast and open hearth or basic oxygen steel-making furnaces

Source: Resource Planning Institute, Raw Materials Transportation Costs and Their Influence on the Use of Wastepaper and Scrap Iron and Steel, vol. 1. Springfield, Va.: National Technical Information Service, PB 229-816, 1974, p. 42.

Figure 8. Locations of iron and steel scrap dealers and broker concentrations, open hearth or basic oxygen steel-making furnaces and integrated blast and open hearth or basic oxygen steel-making furnaces.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LOUISIANA
MISSISSIPPI
FLORIDA
SOUTHWEST
1/8" width represents 500 ton interregional movement
1/8" diameter represents 10,000 ton intraregional movement

Source: Resource Planning Institute, Raw Materials Transportation Costs and Their Influence on the Use of Wastepaper and Scrap Iron and Steel, vol. 1. Springfield, Va.: National Technical Information Service, PB 229-816, 1974, p. 61.

Figure 9. Interregional and intraregional rail movements of scrap iron and steel - 1969.

scrap and wastepaper are held for only short periods of time.* Furthermore, because the shipping certificate calls for delivery from current production, the present shortage of adequate storage facilities for delivery of scrap from inventory would not pose a significant problem.

It might be useful at this point to give two examples of when and how delivery might take place on a scrap futures contract, in order to illustrate some of the concepts discussed in this section.

(A) A Pittsburgh-based steel mill buys a July ferrous scrap futures contract calling for delivery in Pittsburgh at $55 a ton. At the end of May, the steel mill consults the cash market and finds that the current available cash price for that grade of scrap is $52 a ton plus freight from Youngstown at $9.50 a ton. Since the total cost of purchasing the scrap on the cash market is $61.50 a ton, the buyer would stand for delivery under the terms of the futures contract. At this point, the seller of that contract would issue, through the clearinghouse, a shipping certificate to the buyer giving him title to the scrap and asking the buyer to specify a delivery point. If, however, the cash price for the scrap had been $45 a ton, the steel mill would have bought in the cash market and sold the futures contract at the going price of $56.

(B) A steel mill in the Youngstown area is faced with the same price and availability situation described in (A). It can elect to take delivery on the futures market at $55 a ton plus freight to Youngstown or to take delivery in the cash market at $52 a ton. It would clearly be more profitable for the mill to sell the futures contract and to buy in the cash market.

These examples should adequately emphasize the importance of sufficient numbers of suppliers and buyers in the base point marketing city as a means of insuring that some deliveries in satisfaction of futures contracts can, in fact, take place. Unless there are enormous price differentials between the base point city and other consumption centers, buyers in the non-base point markets will never use the futures markets as delivery mechanisms, but only as hedging markets.

If, after a trial period, the futures market is biased relative to the cash market because of insufficient threat of delivery, it would be possible to specify non-par delivery points in the contract. If, for example, it were found that a wastepaper contract based on New York delivery was too limited in scope, it might be possible to use another major marketing point (e.g., Chicago) as a non-par point. In that case, deliveries on the market could be made to both Chicago and New York, although the contract price would still be in terms of delivery to the par location. Prices at non-par points would be calculated by discounting the contract price by an amount reflecting the difference in delivery and marketing costs between the par and non-par points.

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*It has been suggested that the use of a warehouse receipt might help develop an inventory holding system for wastepaper and ferrous scrap that would act as a buffer to large price swings. Although perhaps conceptually appealing, institution of such a system may lack industry support, since large inventory holdings are not a part of their normal business operations.

In order for a contract allowing delivery at non-par points to be an effective hedging device for traders in the non-par markets, a stable and predictable relationship must exist between the cash price in the non-par market and the futures price in the par delivery market. This stability will not be possible if the markets for a particular commodity are distinct, with different factors affecting prices in each area.

The cash prices for ferrous scrap are highly correlated among U.S. cities (see Appendix C), with the exception of San Francisco. This high degree of correlation is not surprising, since demand for scrap is tied to demand for steel products in general, which in turn is tied to business cycle swings in the overall economy.

The cash prices for selected grades of wastepaper are not as closely correlated among different cities as are those for ferrous scrap. Although the price correlations for a single grade of wastepaper among different cities are rather high (except between the west coast and the other cities), the correlation between grades by city are somewhat low.*

One last point concerning non-par delivery points should be made. The existence of alternative delivery points creates uncertainty for the buyer, since the point from which or to which delivery will be made is at the seller's discretion. Thus, the buyer is at a disadvantage. This will generally result in a distortion of the cash price relative to the future price. This is not necessarily bad, if this distortion is known with some certainty and can be accurately predicted.*

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*The low correlations for the wastepaper prices are, in part, due to the manner in which the data is reported. The prices are not continuous, but instead are discrete in the sense that prices tend to move from one level to another in jumps rather than in smooth gradation. This suggests that the prices used here are probably not true market prices.

Inspection of commodities to be delivered on a futures contract is done either by the government or by private agencies overseen by the exchange clearinghouse. Typically, an exchange will attempt to follow accepted industry practices as closely as possible in designing the inspection terms for the contract.

Inspection procedures vary widely depending on the commodity in question. There is no formal inspection of certain commodities, such as metals. Instead, the exchange relies upon the integrity and guarantees of the refiner. For plywood, certified Western Plywood Association (WPA) graders conduct inspections at the loading point, using WPA-established standards. When government standards exist, they are generally used by an exchange in designing the contract, and the government usually takes responsibility for inspection.

In the ferrous scrap and wastepaper industries, no formal inspection by an independent source is conducted. Instead, the buyer generally has the right to inspect and grade all purchases. This is called the "right of rejection." After making delivery, the seller has the option of accepting the decision of the buyer or shipping the delivery back.

At least for ferrous scrap, the extensiveness of the inspection procedures varies according to the grade of scrap supposedly being delivered. The higher the grade, the less inspection. All deliveries are visually inspected. For wastepaper, only a visual inspection is normally conducted. In both cases, the buyer relies on the past performance of the seller in determining how far to carry the inspection procedures.

When it formulates inspection procedures for scrap futures contracts, an exchange must make certain these procedures are fair and do not favor one side of the market at the expense of the other. Otherwise, the side against which the procedures are biased will not participate in the market. A possible means of ensuring fairness might be to have those sellers who are regular for delivery submit to random inspections by a private agency hired by the exchange. The type and extent of the inspection procedure used should depend on the contract grade chosen.

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*For example, since deliveries on the copper contract traded in New York can be made from any of five or six exchange warehouses, the futures price is always quoted at a discount relative to the cash price of copper. Traders know with great certainty what this discount will be and take it into consideration.

INDUSTRY CONCEPTIONS CONCERNING FUTURES MARKETS

Most of the major objections to a scrap futures market that have been raised by industry members have already been indirectly discussed in this report. Many of these objections reflect a misunderstanding of futures markets and their operation. Just over a year ago, a scrap industry executive outlined what he viewed as the principal problems with a futures contract in ferrous scrap.* Because they mirror what have been found (through correspondence with industry members) to be the general industry concerns regarding both ferrous scrap and wastepaper futures contracts, they will be discussed here.

(A) "There must be a standard product." The issue of contract homogeneity was explored earlier in this section, and the need to redefine contract grade specifications was discussed. This problem, however, also relates to a larger issue, the "right of rejection." On a futures market delivery, the buyer must accept the grade shipped on the contract. Since the buyer has no control over the inspection procedure, it is uncertain whether scrap buyers would be willing to use the market. This, of course, is only a problem when the buyer elects to take delivery on the market, and, even then, the exchange has guaranteed the grade to be delivered by forcing all sellers in the market who want to deliver on futures contracts to submit to an investigation of their financial and personal integrity.** In this case, the buyer should be indifferent as to the identity of the seller.

(B) "Buyers and sellers are unknown to each other." Since all trades on a futures market are made through a clearinghouse, the buyers and sellers are indeed unknown to each other. The problem implied by this statement is that a futures market in scrap would end the standard system of contracting, which relies heavily on the past performance of scrap sellers. As noted in (A), this would not only be the case if a buyer decided to take delivery, and should not be a problem if the exchange guarantees the delivery.

Both (A) and (B), above, indicate that scrap buyers and sellers erroneously perceive futures markets as delivery markets and feel that a futures market will force them to alter their normal methods of operation.

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* From a speech by Ralph Michaels at the Ferrous Division Meeting of BIR, Vienna, Austria, reprinted in Recycling Today, Dec. 1975.

**When disputes arise concerning prices, trades, quantities, etc., exchange rules allow for arbitration without recourse to courts of law except on constitutional or violation of charter by-law grounds [22, p. 17].

(C) "There must be established delivery points." Some specific methods of dealing with this issue were described earlier in this chapter.

(D) There is apprehension that the additional speculators attracted to a futures market would somehow downgrade the integrity of the market, and thus result in price destabilization. Furthermore, there is a general feeling that professional speculators will enter the market and rob industry members of their own speculative profits. Section 4 reviewed the role of the speculator in a well functioning futures market. As to the last point, a futures market would formalize the speculative activities already taking place in the scrap industry. If traders are well informed, they will have the opportunity to generate profits on futures trading as well as on cash market transactions.*

SUMMARY AND CONCLUSIONS

This chapter has pointed out several aspects of the ferrous scrap and wastepaper markets that need to be considered in designing a futures contract in either commodity. The lack of a standard pricing and inspection procedure, the lack of a central marketing place, and the fears and/or misconceptions of industry members concerning futures markets must be overcome if futures contracts in those commodities are to be successful.

A futures market in ferrous scrap or wastepaper is technically feasible. With one exception, none of the issues raised here are insurmountable. The exception is the lack of correlation among the prices of different grades of wastepaper. Before any conclusion can be reached concerning the effectiveness of a wastepaper contract, a detailed analysis of the relationship between wastepaper prices must be conducted.

The next chapter considers the possible impacts of a hypothetical scrap futures contract on the markets for ferrous scrap and wastepaper.

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*Of course, a futures market would increase the competition for speculative profits. Some who gained without a futures market would lose with a futures market.

SECTION 6

IMPACTS OF FUTURES TRADING ON MARKETS FOR SECONDARY MATERIALS

The impacts of a futures contract in a particular secondary material can be projected only to the extent that the reactions or responses of users of the contract are known. In a broad theoretical context, it is possible to consider how profit-maximizing behavior on the part of scrap dealers and scrap consumers would be affected by the availability of a scrap futures contract.

In addition to the use of theoretical predictions, insight into the actual impacts of futures trading can be gained through an analysis of historical data. Although restricted to commodities other than scrap, historical data do provide a basis for making inferences as to the effect of futures trading on market supply and demand curves. Section 4 and Appendix E discuss some of the empirical work in this area and contain, as well, an econometric analysis of the impact of futures trading on plywood supply response.

This section of the report is devoted to a theoretical discussion of the effect of futures trading on buyers and sellers of secondary materials. The class of affected individuals and organizations can be divided into two groups: (1) participants in futures trading; and (2) nonparticipants. The first group includes scrap dealers and scrap-consuming mills, who would use a futures market to hedge their actual or planned market positions, and speculators, who would use a futures market for potential financial gain. The second group, or nonparticipants directly affected by a futures market, are those dealers and user mills who base inventory and production decisions at least in part on published futures market prices.

PARTICIPANTS

As noted in Section 4, dealers and consumers of secondary materials could use a futures market to hedge their actual or anticipated cash positions in scrap. A futures market enables both buyers and sellers to hedge their present and future cash positions, and to thus remove that element of business risk associated with uncertain prices for the product. In effect, hedging in a futures market, when such a market exists, is consistent with sound business practice.

Hedging would increase producer and consumer income stability and result in improved access to capital for dealers and users. Scrap dealers, in particular, would be viewed as better credit risks by banks and other lenders. Both the terms of credit and the absolute amounts of credit extended should, therefore, be more favorable to the scrap dealer. In a similar vein, smaller user mills should find their terms of credit on capital markets to be improved. As a general rule, stable income histories enable bonds to be floated at a lower interest rate. Likewise, the stock market would demand a lower average return for firms with stable earnings and dividend histories. In sum, lending institutions and financial markets demand a premium for risk, and if this risk can be reduced through hedging on a futures market, a potential borrower can expect to receive new capital on more favorable terms.

Hedging may be of additional use to scrap-consuming mills. Although unpredictable input costs have a significant impact on net income at many mills, a more pressing concern at other mills is, at times, the physical availability of certain grades of scrap in the quantities required to maintain the desired level of operations. Hedging against future scrap needs can reduce quantity/availability uncertainties as well as price risks.

In the longer run, the risk management role of hedging on futures markets, by both dealers and user mills, should have an indirect impact on their level of investment in plant and equipment. The theoretical literature on investment under uncertainty is clear. Uncertainty reduces the level of investment; as a corollary, a reduction in the level of uncertainty in an industry should, in general, result in an increase in the level of investment. In terms of the secondary materials markets, a scrap futures market might reduce the incentive to rely on primary inputs.

NONPARTICIPANTS

Organized futures trading affects sellers and buyers even when they do not directly participate in the futures market. One of the principal functions of a futures market is its forward pricing role. The forward or futures prices are published daily in many major newspapers and are therefore readily available to nonparticipants as well as futures market participants. The forward prices represent unbiased estimates of the prices that will prevail at the future dates.

Nonparticipants in futures trading may or may not base their price expectations on the published futures prices, but the ready availability of the published prices does indicate that they will be used fairly extensively. To the extent these prices are used in forming dealer and user price expectations, they will affect inventory decisions, production plans, and short-run investments.*

CONCLUSIONS

Futures trading in scrap could result in (1) greater reliance on secondary materials as inputs to production processes; (2) improved credit terms for firms that use the futures market for hedging purposes; and (3) an increased level of investment in scrap processing, both by the dealer and by the user mill.

If organized futures trading in scrap is instituted, the supply of scrap from dealers is likely to shift outward and become more elastic. Likewise, the demand for scrap by user mills could shift outward and become more elastic. The actual changes may be small but the expected direction of change is unquestionable. The net effect on scrap markets would be greater price stability and an increase in the quantity of scrap recovered and reused.**

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* To substantiate the above-mentioned hypothetical uses of futures markets by scrap industry members, an informal telephone survey was conducted in wich a number of copper scrap dealers/processors were interviewed as to their use of and participation in the copper futures markets. The results of these interviews are presented in Appendix F.

**See Section 3.

SECTION 7

PRIVATE AND SOCIAL RETURNS FROM LISTING A NEW COMMODITY FOR FUTURES TRADING

This section examines the resource allocation question faced by a private commodity exchange in deciding whether to list a commodity for futures trading. The question is, does the market mechanism that influences an exchange's decision provide the proper signals so that the socially optimal number of commodities will be listed? This is important not only for scrap futures, but also for other commodities for which there is no active futures market at present.

The basic market mechanism affecting an exchange's decision is that of competition. No single exchange has monopoly power; they must compete with each other for the commodities to be listed. Their decision as to whether to list a contract is based on assessment of the anticipated revenues and expenses of such a listing.

Exchanges have several sources of revenue. Generally, the three most important are (1) interest on clearing funds; (2) fees; and (3) investments. All commission houses are required to deposit, in exchange accounts, a portion of the margin requirements posted by the customers of the houses. The exchange returns the funds when an account is cleared, but retains the accrued interest. During periods of high interest rates, the interest paid on clearing funds may represent the largest single source of income to the exchange. In addition, an exchange will charge set fees--either clearing fees, which are generally a small percent of the commission fees paid by the commission house's members, or service fees, a per traded contract charge. Many exchanges also obtain revenue from real estate holdings and other investments. Annual dues paid by exchange members for the privilege of trading on the exchange are a fourth source of income. Normally, dues contribute an insignificant amount of revenue to the exchange.

The costs of listing a contract for futures trading are:*

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*The costs and benefits of futures trading, as distinct from the costs and benefits of listing a commodity for futures trading, is the subject of some recent interest. See [45].

(1) costs of research involved in developing the futures contract; (2) costs of promoting futures trading in the relevant commodity (e.g., informing potential buyers and sellers as to the nature of the process and the advantages to be gained); and (3) indirect costs associated with the risk of losing prestige and trader confidence should the contract fail. Once trading has been initiated, there are (4) the costs of storage, theft prevention, registration, assaying and inspection, as well as the normal operating expenses.

Because of the importance of the first two revenue sources, exchanges are extremely interested in increasing trading volume on their floors and in initiating new contracts that will attract substantial trading interest. Since it is in an exchange's interest to initiate new contracts, it may be asked whether the private, exchange benefits are less than the social benefits, thereby inducing an exchange to initiate fewer than the optimal number of futures contracts.

The following discussion will argue that this is the case, and that there is indeed an economic justification for government involvement in the research and initiation of futures contracts.

PUBLIC GOOD ASPECT OF FUTURES TRADING

The public good aspect of market information constitutes one important rationale for governmental support of the commodity exchanges' functions. It means, in essence, that the revenues earned by the exchange may not be related to the benefits provided to society and that an exchange may receive the wrong signals from the marketplace.

An exchange is able to recoup part of the value of the futures trading through commissions paid by traders. However, the market information contained in the futures prices can be used by anyone without trading, and an exchange will not be compensated for its full value. In this sense, futures trading generates a public good. The costs of excluding a potential user from the futures prices are prohibitive, and one individual's use of the information does not impair the usefulness for another. In other words, the opportunity cost to an exchange of extending utilization to another person is zero, or at least close to it.

The theory of public good demonstrates that when the private sector does not receive the appropriate demand signals for an efficient production level, less than the socially optimal amount of the good will be produced. The proper role for the public section is to "aggregate consumers' demand for these goods and express it to the private sector" [39, p. 95]. In terms of futures markets, this means that the "publicness" or "semi-publicness" of the market information produced through futures trading may result in exchanges researching and initiating for futures trading less than the socially optimal number of commodities. Only governmental intervention in the market can provide the necessary signals to an exchange to induce the optimal production of futures contracts.

The government has already set a precedent of public involvement in commodity exchange procedures by such actions as government inspection of some agricultural commodities, sponsorship of research on the characteristics of certain futures markets, and futures trading feasibility studies. The comments made here suggest an extension of the current government role.

EXTENT OF GOVERNMENT PARTICIPATION

Economic theory provides the general criteria for determining the proper level of public investment in supporting futures trading of selected commodities; marginal social costs should be equated to marginal social benefits.

The social costs are relatively easy to delineate. These include the costs borne by the exchange, as discussed above, as well as any costs incurred by the government in researching, promoting, or actively participating in the futures market. Some critics of futures trading in ferrous scrap have argued that the costs of inspecting scrap to be delivered on a futures contract would be so high as to preclude trading. Telephone conversations with scrap buyers indicate that inspection costs for a ton of ferrous scrap range roughly from $1.50 to $2.00 per ton, depending on the grade and type of inspection. Assuming a contract size of 40 tons, this translates into a total inspection bill of $60 to $80 per contract. Even if these figures are underestimated, they would compare favorably with the typical inspection charges for existing contracts traded on commodity exchanges. For example, inspection charges paid by the seller on the New York Mercantile Exchange range from $20 per contract for potatoes to $150 per contract for platinum.

Measurement of the benefits is more elusive. What is the value of the benefits that will accrue to society due to the ability of scrap industry members to hedge against price uncertainty? What is the value to consumers, or to society, of better information, in the sense of more informed futures prices? Last, what is the value of a more efficient allocation of resources between secondary and primary materials?*

Given that a quantitative comparison of costs and benefits from government participation in the research, initiation, and continuing support of futures trading in a particular commodity is likely to produce incomplete results because of the relative difficulty of measuring benefits, some sort of ad hoc quasi-political assessment is necessary. Three broad levels of government involvement in futures trading in scrap materials have been identified. Each one requires financial support from the government.

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*A recent study by the Environmental Law Institute, funded by the U.S. EPA, sheds some light on this issue. See [4].

First, the government could become closely involved with the research and initiation phases of futures trading. It has already accepted part of this role by financing this study. Additional participation might require sponsorship of industry seminars to educate potential users of the usefulness of a scrap futures contract, or provision of its technical and legal expertise to the exchange to aid in preparation of the actual contract. Second, the government may decide to accept as its responsibility certain aspects of regulating trading in the market, such as acting as commodity inspector. Third, in the event of lack of trading interest, it has been suggested that the government could actively enter the market as a participant to bolster trading volume or grant subsidies to an exchange to insure continued listing of the contract.*

Because of the high potential benefits from a scrap futures contract, there appears to be ample justification for the government to accept a role that encompasses the first two involvement levels. Much of the education role can be conducted through established frameworks, such as the Scrap Advisory Committee. In addition, there is a precedent of government involvement in inspection routines and regulatory oversight. Furthermore, if a contract is designed that appeals to industry members, there would be no need for the government to worry about assuring sufficient trading volume. If sufficient trading were not generated in a scrap futures contract after a certain period of time (many contracts have taken a year or more to become established), the desirability of direct governmental participation in the market should be reexamined.

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*Such a governmental role has been suggested by McKinnon and others, but only in terms of acting as a buyer of distant contracts [31]. It is, basically, the competitive nature of futures markets that generates the benefits from futures trading mentioned earlier in this paper and, in this sense, direct government participation in futures trading is usually considered to be "inimical to futures trading" [18, p. 100].

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APPENDICES

APPENDIX A. PREDICTION OF SECONDARY AND PRIMARY MATERIALS PRICES

In order to test the hypothesis that secondary materials prices are less predictable than primary materials prices, it was necessary to develop a forecasting model that, when applied to the price series for primary and secondary materials, could generate predictions for those prices.

One simple method of forecasting future values of the prices is to postulate a linear auto-regressive relationship between past prices and current price of the general form:

$$(1) \; \ldots\ldots \; X_t = \gamma_1 X_{t-1} + \gamma_2 X_{t-2} + \ldots + \gamma_p X_{t-p} + \beta_o + U_t$$

Equation (1) shows the current price of the commodity, X_t, as a function of past prices lagged to period p, where $p \leq t$. To simplify estimation procedures, it was assumed that the current price was a function of price in the preceding period, or:

$$(2) \; \ldots\ldots \; X_t = \gamma_1 X_{t-1} + \beta_o + U_t$$

Once the parameters have been estimated, equation (2) can be used to forecast future values of price, since:

$$(3) \; \ldots\ldots \; X_{t+1} = \hat{\gamma}_1 X_{t+i-1} + \hat{\beta}_o$$

For example, if equation (2) is estimated with monthly data up to December 1975, the value for X in January 1976 can be predicted by substituting the value of X in December 1975 into equation (3).

$$(4) \; \ldots\ldots \; X_{Jan.\ 1976} = \hat{\gamma}_1 X_{Dec.\ 1975} + \hat{\beta}_o$$

Equations for pig iron, ferrous scrap (all grades), No. 1 Heavy Melting, woodpulp, wastepaper (all grades), and Old Corrugated Boxes were estimated by ordinary least squares using monthly wholesale price indices for the years 1963-75.* The estimated coefficients appear in Table A-1. Using the estimated equations, forecasts of prices for each of the first four months in 1976 were generated for each commodity series.

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*Ordinary least squares is by no means the only estimation technique that could have been used. For a complete description of time series models and their estimation, see C. R. Nelson, Applied Time Series Analysis (San Francisco: Holden-Day, Inc., 1973).

To compare the relative predictive power of the data, the predicted values for price in 1976 were compared to the actual values using a statistical parameter called Theil's U-measure. Theil's U-values are calculated by the formula:

$$U = \frac{\sqrt{1/N \sum (X^*_t - X_t)^2}}{\sqrt{\sum (X_t^*)^2} + \sqrt{\sum (X_t)^2}}$$

where: X^*_t = the predicted value of X in period t

X_t = the actual value of X in period t

A U-value of 0 indicates perfect explanation of the data series by the model; a value of 1 indicates no explanatory power. The Theil U-measures for the primary and secondary commodities are reported in Table A-2.

The results were as expected. The best predictions came from the primary materials, while the worst were for the particular grades of secondary products. The U-values for No. 1 Heavy Melting and Old Corrugated Boxes are over five times as great as for the primary materials. The validity of these conclusions is at least partly dependent on the accuracy of the

TABLE A-1. ESTIMATED PRICE FORECASTING EQUATIONS FOR PRIMARY AND SECONDARY MATERIALS (JANUARY 1963 TO DECEMBER 1975)

Price_t	C	Price_{t-1}	R^2
Pig iron	-20.69	1.02	0.99
Ferrous scrap	40.69	0.98	0.95
No. 1 heavy melting	5.09	0.97	.94
Woodpulp	-14.36	1.02	.99
Wastepaper	32.23	0.98	.96
Old corregated boxes	36.89	0.97	.95

reported prices that were used. Because of the largely vertically integrated nature of the paper and steel industries, prices for the primary materials tend to be administered prices and, as such, may not reflect actual demand and supply conditions. Consequently, the results obtained may overstate the predictability of primary prices, due to inaccuracies in the reporting of woodpulp and pig iron prices. On the other hand, scrap prices that are not under the mills' control are probably much more accurate because they are sensitive to changing market conditions.

TABLE A-2. THEIL'S U-VALUES FOR PRIMARY AND SECONDARY PRICE PREDICTIONS

Commodity	U-Value
Pig iron	0.029
Ferrous scrap (all grades)	0.120
No. 1 heavy melting	0.152
Woodpulp	0.016
Wastepaper (all grades)	0.095
Old corrugated boxes	0.179

APPENDIX B. CORRELATION ANALYSIS OF WASTEPAPER AND FERROUS SCRAP BY GRADE

Tables B-1 and B-2 are the correlation matrices of the monthly wholesale price indices for six different grades of wastepaper and four different grades of ferrous scrap. Undeflated data for the years 1964-1975 were used. A value of 1 indicates complete or perfect correlation; a value of 0 indicates no correlation.

TABLE B-1. CORRELATION MATRIX OF WASTEPAPER PRICES BY GRADE

Item*	SCKC	N1NW	N1M	WNB	ØCC	MKC
SCKC	1.00	.71	.77	.85	.88	.56
N1NW	.71	1.00	.90	.77	.76	.41
N1M	.77	.90	1.00	.75	.90	.45
WNB	.85	.77	.75	1.00	.76	.48
ØCC	.88	.76	.90	.76	1.00	.52
MKC	.56	.41	.45	.48	.52	1.00

*Abbreviations:
SCKC - Semi-chemical kraft clippings
N1NW - Number 1 newsprint
N1M - Number 1 mixed
WNB - White news blanks
ØCC - Old corrugated containers
MKC - Mixed kraft clippings

TABLE B-2. CORRELATION MATRIX OF FERROUS SCRAP PRICES BY GRADE

Item*	N1HM	N2HM	N1B	N2B
N1HM	1.00	.99	.99	.98
N2HM	.99	1.00	.98	.98
N1B	.99	.98	1.00	.97
N2B	.98	.98	.97	1.00

*Abbreviations:
N1HM - Number 1 heavy melting
N2HM - Number 2 heavy melting
N1B - Number 1 bundles
N2B - Number 2 bundles

APPENDIX C. CORRELATION ANALYSIS OF WASTEPAPER AND FERROUS SCRAP PRICES BY GRADE AND BY CITY

Table C-1 is the correlation matrix of the monthly wholesale price indices for ferrous scrap grades by city. Tables C-2, C-3, C-4, and C-5 are the correlation matrices for selected grades of wastepaper by city. The ferrous scrap matrix is based on undeflated data for the years 1964-1975 as published

TABLE C-1. CORRELATION MATRIX OF FERROUS SCRAP PRICES BY GRADE BY CITY

Item*	N2HMPI	N1BB	N1BC	N1BP	N1BPI	N1BS	N2BB
N1HMB	.95	.98	.97	.96	.96	.95	.96
N1HMC	.98	.96	.99	.97	.98	.94	.95
N1HMP	.97	.98	.98	.98	.98	.96	.96
N1HMPI	.98	.96	.98	.97	.99	.93	.96
N1HMS	.92	.93	.93	.94	.93	.98	.93
N2HMB	.96	.95	.95	.94	.94	.93	.96
N2HMC	.96	.95	.98	.96	.97	.93	.93
N2HMP	.97	.96	.97	.98	.97	.94	.96
N2HMPI	1.00	.95	.97	.95	.97	.92	.96
N1BB	.95	1.00	.97	.97	.97	.95	.94
N1BC	.97	.97	1.00	.97	.98	.95	.94
N1BP	.95	.97	.97	1.00	.97	.95	.95
N1BPI	.97	.97	.98	.97	1.00	.94	.94
N1BS	.92	.95	.95	.95	.94	1.00	.93
N2BB	.96	.94	.94	.95	.94	.93	1.00

in _Wholesale Prices and Price Indices_, Bureau of Labor Statistics. The wastepaper matrices were based on undeflated prices as published in Fibre Market News; the years 1973-1977 were used.*

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*The monthly prices used in the correlation analysis for wastepaper are averages of the prices quoted in the Friday editions of _Fibre Market News_. Since the prices are quoted as ranges, the midpoint in the range was used.

TABLE C-1 (CONTINUED). CORRELATION MATRIX OF FERROUS SCRAP PRICES BY GRADE BY CITY

Item*	N1HMB	N1HMC	N1HMP	N1HMPI	N1HMS	N2HMB	N2HMC	N2HMP
N1HMB	1.00	.97	.97	.96	.94	.97	.95	.96
N1HMC	.97	1.00	.98	.98	.94	.96	.98	.97
N1HMP	.97	.98	1.00	.98	.95	.95	.97	.99
N1HMPI	.96	.98	.98	1.00	.93	.96	.97	.98
N1HMS	.94	.94	.95	.93	1.00	.92	.93	.95
N2HMB	.97	.96	.95	.96	.92	1.00	.95	.96
N2HMC	.95	.98	.97	.97	.93	.95	1.00	.96
N2HMP	.96	.97	.99	.98	.95	.96	.96	1.00
N2HMPI	.95	.98	.97	.98	.92	.96	.96	.97
N1BB	.98	.96	.98	.96	.93	.95	.95	.96
N1BC	.97	.99	.98	.98	.93	.95	.98	.97
N1BP	.96	.97	.98	.97	.94	.94	.96	.98
N1BPI	.96	.98	.98	.99	.93	.94	.97	.97
N1BS	.95	.94	.96	.93	.98	.93	.93	.94
N2BB	.96	.95	.96	.96	.93	.96	.93	.96

*Abbreviations:
N1HMB - Number 1 heavy melting, Birmingham
N1HMC - Number 1 heavy melting, Chicago
N1HMP - Number 1 heavy melting, Philadelphia
N1HMPI - Number 1 heavy melting, Pittsburgh
N1HMS - Number 1 heavy melting, San Francisco
N2HMB - Number 2 heavy melting, Birmingham
N2HMC - Number 2 heavy melting, Chicago
N2HMP - Number 2 heavy melting, Philadelphia
N2HMPI - Number 2 heavy melting, Pittsburgh
N1BB - Number 1 bundles, Birmingham
N1BC - Number 1 bundles, Chicago
N1BP - Number 1 bundles, Philadelphia
N1BPI - Number 1 bundles, Pittsburgh
N1BS - Number 1 bundles, San Francisco

(abbreviations continued on next page)

*Abbreviations (continued):
N2BB - Number 2 bundles, Birmingham
N2BC - Number 2 bundles, Chicago
N2BP - Number 2 bundles, Philadelphia
N2BPI - Number 2 bundles, Pittsburgh
N2BS - Number 2 bundles, San Francisco

TABLE C-2. CORRELATION MATRIX OF WASTEPAPER PRICES BY GRADE FOR NEW YORK AND CHICAGO

Item*	HWEC	FNC	MPC	OCBC	WLSC
HWEN	.99	.78	.37	.79	.97
FNN	.70	.97	.58	.84	.72
MPN	.42	.54	.96	.75	.45
OCBN	.64	.80	.82	.96	.68
WLSN	.94	.85	.44	.86	.95

*Abbreviations:
HWEC - Hard white envelope cuttings, Chicago
HWEN - Hard white envelope cuttings, New York
FNC - Folded news, Chicago
FNN - Folded news, New York
MPC - Number 1 mixed paper, Chicago
MPN - Number 1 mixed paper, New York
OCBC - Old corrugated boxes, Chicago
OCBN - Old corrugated boxes, New York
WLSC - White ledger stock, Chicago
WLSN - White ledger stock, New York

TABLE C-3. CORRELATION MATRIX OF PRICES FOR HARD WHITE ENVELOPE CUTTINGS BY CITY

Item*	HWEC	HWEN	HWEPA	HWEP	HWEPI
HWEC	1.00				
HWEN	.99	1.00			
HWEPA	.77	.77	1.00		
HWEP	.99	.99	.79	1.00	
HWEPI	.97	.98	.81	.98	1.00

*Abbreviations:

HWEC - Hard white envelope cuttings, Chicago
HWEN - Hard white envelope cuttings, New York
HWEPA - Hard white envelope cuttings, Pacific
HWEP - Hard white envelope cuttings, Philadelphia
HWEPI - Hard white envelope cuttings, Pittsburgh

TABLE C-4. CORRELATION MATRIX OF PRICES FOR OLD CORRUGATED BOXES BY CITY

Item*	OCBC	OCBN	OCBB	OCBPA	OCBP	OCBPI
OCBC	1.00					
OCBN	.96	1.00				
OCBB	.97	.93	1.00			
OCBPA	.73	.59	.78	1.00		
OCBP	.92	.97	.88	.39	1.00	
OCBPI	.96	.96	.91	.52	.95	1.00

*Abbreviations:

OCBC - Old corrugated boxes, Chicago
OCBN - Old corrugated boxes, New York
OCBB - Old corrugated boxes, Boston
OCBPA - Old corrugated boxes, Pacific
OCBP - Old corrugated boxes, Philadelphia
OCBPI - Old corrugated boxes, Pittsburgh

TABLE C-5. CORRELATION MATRIX OF WASTEPAPER PRICES BY GRADE WITHIN NEW YORK AND CHICAGO

Item*	HWEC	WLSC	OCBC	FNC	MPC
HWEC	1.00				
WLSC	.98	1.00			
OCBC	.77	.81	1.00		
FNC	.70	.79	.91	1.00	
MPC	.50	.52	.79	.59	1.00

Item*	HWEN	WLSN	FNN	OCBN	MPN
HWEN	1.00				
WLSN	.96	1.00			
FNN	.72	.83	1.00		
OCBN	.45	.67	.77	1.00	
MPN	.41	.48	.56	.84	1.00

*Abbreviations:
HWEC - Hard white envelope cuttings, Chicago
WLSC - White ledger stock, Chicago
OCBC - Old corrugated boxes, Chicago
FNC - Folded news, Chicago
MPC - Number 1 mixed paper, Chicago
HWEN - Hard white envelope cuttings, New York
WLSN - White ledger stock, New York
FNN - Folded news, New York
OCBN - Old corrugated boxes, New York
MPN - Number 1 mixed paper, New York

APPENDIX D. THE 1954 SCRAP IRON AND STEEL FUTURES CONTRACT

A futures contract in secondary materials is not without precedent. In 1954, a futures contract in scrap iron and steel was introduced on the Chicago Mercantile Exchange. The contract called for delivery of a 40-ton car of No. 1 Heavy Melting steel, with No. 2 Heavy Melting also deliverable on the contract at a set discount of $5 per ton. Delivery months were January, April, July, and October.

The contract was a dismal failure. Only 275 contracts were traded before the contract was closed out one year later. The trading volume represented only one-fortieth of one percent of all the ferrous scrap traded in the United States that year.

Although the precise circumstances surrounding the scrap contract failure are not fully known, a few reasons for the contract's failure seem obvious. Both buyers and sellers were opposed to the contract as it was written. The contract provided for inspection of the commodity by a private firm even though scrap buyers were accustomed to inspecting their own purchases. Many local branches of the scrap dealers' trade association made public denouncements of the scrap contract. Evidently, the contract was designed with very little industry participation. Lacking hedging volume, the contract was unable to attract the necessary speculative trading. Furthermore, it is likely that many professional traders were not familiar with the scrap markets. They were not able to interpret the relevant demand and supply information and, therefore, were not sure of what position to take in the market.

The 1954 contract was plagued by a grading problem, to which a bad delivery testifies. No. 2 scrap was delivered as the par grade to a buyer who had paid for No. 1 scrap. It appears that the specifications were not precise enough or that inspection enforcement was not strict enough to rule out the possibility of another grade being delivered as the par grade. Whether this was due to sloppy inspection or loopholes in the specifications is unclear.

The failure of the 1954 ferrous scrap contract serves to emphasize the importance of an exchange working closely with industry representatives in designing a functional and acceptable futures contract.

APPENDIX E. IMPACT OF FUTURES TRADING ON SOFTWOOD PLYWOOD SUPPLY RESPONSE

This section represents an attempt to verify the hypothesized model of the impacts of futures trading on supply response. Softwood plywood was chosen for this analysis because it is a rather new futures contract, initiated in late 1969, thus insuring that sufficient pre- and post-futures trading data could be collected (assuming it was available on a monthly basis and covered the variables of interest).

The procedure used to test for the impact of futures trading on plywood supply behavior is straightforward. First, an econometric expression of the monthly supply behavior for the softwood plywood market was developed and estimated for the years 1965-1975. Second, the price variable was divided into two components, one representing the price of plywood before futures trading, and one the price after futures trading. The supply equation was reestimated using the two price variables, and the estimated coefficients were compared to test the hypothesis that supply becomes more responsive to price after the initiation of futures trading. The following discussion outlines the model and the test procedure in more detail.

The Model

The supply of a commodity is typically considered to be a function of output price, input prices, prices for competing outputs, and the state of technology in the industry. An increase in output price or in productivity would, everything else being equal, be associated with an increase in quantity supplied. An increase in input costs or in the price of competing outputs would normally have a dampening effect on supply. Theoretically, these are the relationships that should be used to describe the supply of softwood plywood.

Although economic theory clearly prescribes the relevant variables to be used in estimating the supply function for a commodity, the ability to obtain data on these variables limits the empirical research. This was almost certainly part of the reason for the disappointing results obtained in the only previous econometric study of plywood supply.* McKillop took supply to be a function of the current price of plywood, the price of veneer logs, wages in sawmills, the price of electric power, productivity in sawmilling (a proxy for productivity in plywood production), and a dummy variable [30]. The results, based on annual data, were discouraging. Only three variables--the dummy, the price of veneer logs, and wages in sawmilling--were significant and, of these, only the price of veneer logs had the proper sign.

The supply equation for the model was specified on a monthly data base. Despite the even more severe data limitations imposed by using a monthly base, as opposed to an annual or quarterly one, it was felt necessary to use monthly data to insure a sufficient number of observations for the period after futures trading. The supply equation was specified as follows:**

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* In his study of the plywood futures market, Story estimated a reduced form equation to test for the impacts of futures trading. Because this equation could not be associated with either a supply or demand equation, it is not discussed here.

**Several other functional forms (nonlinear) for the supply equation were tested. The linear form was finally chosen as that which provided the best fit, explained the most variance in the dependent variable, and provided parameter estimates that were the most reasonable in light of underlying economic theory.

(1) ... $QP_t = a_0 + a_1\ PP_t + a_2\ TR_t + a_3\ LRIM_{t-6}$

where: QP = production of softwood plywood - 3/8" basis

PP = deflated wholesale price index of softwood plywood - 1967 = 100

TR = trend variable (1 in the first month and increasing by 1 each successive month)

LRIM = Almon lag on the ratio of mill inventories to mill production

The supply of softwood plywood was characterized as a function of the current price of plywood, a trend variable, and the ratio of mill inventories to mill production. The trend variable was included as a proxy for changes in productivity and technology in the industry. This would include, for example, the development of new technologies that have permitted the use of different species of wood and smaller log sizes in plywood production. The impact of mill inventory levels on production is captured through the ratio variable. In general, the larger the ratio (that is, the larger the level of past inventories relative to past production), the smaller the current production level. Prices of substitute outputs were not included, since the substitution possibilities for a plywood mill, if they existed at all, would be extremely limited in the short run. The expected signs for the coefficient, as suggested by economic theory, are listed in Table E-1.

TABLE E-1. EXPECTED SIGNS FOR REGRESSION COEFFICIENTS

Supply	Sign
a_1	positive
a_2	positive
a_3	negative

The estimated supply equation was:*

$$(2)\ \ldots QP_t = 926.01 + \underset{(3.4)}{2.71}\ PP_t + \underset{(4.0)}{2.98}\ TR_t - \underset{(-1.8)}{433.39}\ LRIM_{t-6}$$

$$R^{2**} = 0.83 \quad \rho^{**} = .562 \quad RSS = 789880$$

All coefficients display the proper sign and were significant at the 10 percent confidence level.

The estimated supply elasticity with respect to price was 0.25. The McKillop study derived an estimate of 0.378 for the supply elasticity [30, p. 45]. The higher elasticity of supply can be explained by their use of annual data.

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* The supply equation was estimated using monthly data on the years 1965-1975. The estimation procedure employed was two-stage least squares, which implies the existence of additional equations describing the endogenous variables which appear as explanatory variables in the equation. Initially, two other equations, describing demand for softwood plywood and mill inventories, were estimated with the supply equation. These equations were specified as:

$$(a)\ \ldots\ QS_t = b_o + b_1\ PP_t + b_2\ CHWI_t + b_3\ FRI_t + b_4\ RES_{t+2}$$

$$(b)\ \ldots\ MI_t = c_o + c_1\ QS_t + c_2\ MI_{t-1}$$

where: QS = quantity of softwood plywood shipped by mills to wholesalers
CHWI = change in wholesalers' inventories
FRI = Federal Reserve Index of Industrial Production, 1967 = 100
RES = deflated value of residential construction
MI = mill inventories of softwood plywood

These were later dropped from the analysis because of incongruous results and the lack of a clear theory as to the impact of futures trading on the specified relationships. The supply equation was corrected for serial correlation by using a first-order correction technique.

**The t-statistics and R^2 have been included as additional information, although their significance with two-stage estimation is dubious. ρ is the value used to correct the problem of first order autocorrelated disturbances in the initial equation.

Impact of Futures Trading

The theoretical impacts of futures trading on the cash market were outlined in Section 4. In general, it can be expected that increased market information will lead to an increase in the responsiveness of supply to price. In other words, a given change in price would elicit a larger adjustment in production levels during the post-1969 period (with futures trading) than it would in the pre-1969 period (before futures trading).

To test this hypothesis, the plywood price variable was divided into two components.* This involved forming two separate variables, P1 and P2, where P1 is the price of plywood for the period before futures trading and zeros thereafter, and P2 is the price of plywood after futures trading with zeros for the period 1965-1969. The supply equation, with P1 and P2, was then estimated on the entire data base, and the estimated coefficients were compared to the estimates from the original equation.** An increase in the responsiveness of supply to price signals would be evidenced by a larger coefficient for P2, relative to P1.

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* Since plywood futures contracts were introduced in late 1969, the before-futures-trading period was taken to 1965-1969, inclusive; the after-futures-trading period was 1970-1975.

**The appropriate statistic for testing the equivalence of two coefficients is an F-statistic defined as:

$$F = \frac{RSS(Hn) - RSS(Ha) / N}{RSS(Ha) / T - K}$$

where: RSS(Hn) = the residual sum of squares under the null hypothesis
RSS(Ha) = the residual sum of squares under the alternative hypothesis
T-K = the degree of freedom in the alternative hypothesis
N = the number of restricted parameters

In the problem discussed here, the hypothesis that coefficients of P1 and P2, say d_1 and d_2, are the same needs to be tested. In this case, the null hypothesis is: Hn: $d_1 = d_2$, the residual sum of squares for which is derived from equation (2). The alternative hypothesis is: Ha: $d_1 \neq d_2$. Equation (3) provides the residual sum of squares under this hypothesis. An F-statistic in excess of 3.93 indicates rejection of the null hypothesis at the 5 percent level, and acceptance of the alternative hypothesis that the two coefficients are significantly different.

The estimated supply equation with the inclusion of P1 and P2 was:

$$(3) \ldots \; Qp_t = 966.04 + \underset{(3.0)}{2.48}\, P1_t + \underset{(4.4)}{3.54}\, P2_t + \underset{(1.9)}{1.54}\, TR_t - \underset{(-1.8)}{398.15}\, LRIM_{t-6}$$

$$R^2 = 0.84 \qquad \rho = 0.45 \qquad RSS = 745300$$

The F-statistic was calculated to be 6.89 supporting rejection of the null hypothesis and acceptance of the alternative hypothesis, at the 5 percent confidence level, that there is a significant difference between the coefficients P1 and P2. The shift in supply response is graphically represented in Figure E-1. Before futures trading, the supply curve is represented by S_1. The period after futures trading corresponds to a shift to the right in the supply curve, or S_2, indicating a more responsive supply curve. As indicated by theory, the supply of plywood became more responsive to price signals after the initiation of futures trading in plywood.*

To assume that the larger coefficient for the price of plywood after futures trading was due to the introduction of futures trading presupposes that the supply equation accounts for all other changes in market structure and conditions that might have affected the price coefficients. A review of the plywood market from 1965-1975 identifies only one major market trend which has not been taken into account that may have had some long-range impact on the relationship between price and quantity. This is the trend, at least during the period analyzed, toward a greater share of the market being controlled by mill-owned or -operated wholesale establishments. Between 1962 and 1971, the amount of total plywood production handled by captive wholesalers increased from 32 percent to 50 percent [9, p. 2]. If this change in industrial structure had any impact on supply, it would have been to decrease the responsiveness of supply to price. Therefore, the shift in the supply response that was attributed to futures trading may understate the true impact.

*A discussion of how the supply elasticities for the pre- and post-futures trading periods can be compared, is presented in Appendix G.

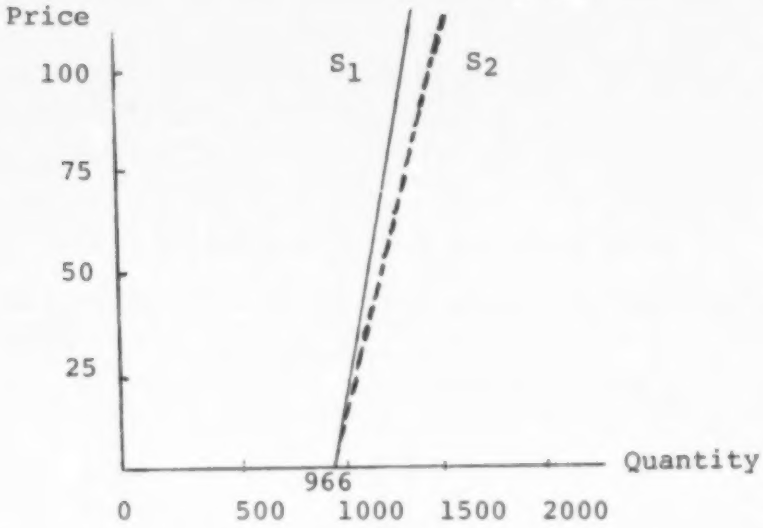

Figure E-1. Supply response before (S_1) and after futures trading (S_2).

APPENDIX F. SCRAP COPPER DEALER INTERVIEW

In an attempt to reconcile the theoretical uses of a futures market with actual experience, an informal telephone interview of several copper scrap dealers was conducted. The interviews concentrated on the participation of those dealers in the New York or London copper futures markets. The possible uses of the copper futures markets by copper scrap dealers and consumers have been described elsewhere in the text, and the interviews were used to obtain better information on the extent to which the futures markets were actually used.

The sampling technique was fairly ad hoc; there was no interest in attaching statistical significance to the responses. Thirty-eight scrap dealers from six cities--New York, Washington, Chicago, St. Louis, Phoenix, and Los Angeles--were chosen on a random basis for the interviews. It was felt that these cities represented the major market regions for non-ferrous scrap. The companies contacted were selected from the 1970 Waste Trade Directory and the yellow pages for those cities. Each firm was asked six questions. The questions and responses are provided in Table F-1.

Of the 38 firms, 12 said they traded in copper futures. Most of the trading was for hedging purposes, although some companies do use the markets for speculative purposes as well. Generally speaking, the larger the firm, the more likely it was to trade in futures markets; of the 12 firms that said they

TABLE F-1. COPPER SCRAP DEALER QUESTIONS AND RESPONSES (SEPTEMBER 1977)

1. What types of scrap metals do you handle?

15 - non-ferrous
23 - ferrous and non-ferrous

2. How would you classify the size of your operation?

19 - small (less than 15 employees)
13 - medium (more than 15 but less than 50 employees)
3 - large (more than 15 employees)
3 - confidential (would not release information)

3. Do you actively trade in the futures markets for copper, either in New York or in London?

12 - yes
26 - no

4. If you trade in copper futures, for what purpose do you trade?

8 - hedging
4 - hedging and speculation

5. If you do not trade in copper futures, why not?

10 - futures markets like gambling; too risky
8 - too small to trade in futures; not worth it
2 - market is too unstable; too much fluctuation in futures markets
6 - miscellaneous; no knowledge; no demand; too crooked

6. Do you follow the futures markets in copper as a source of future market information?

21 - yes; use futures prices as guidelines for production and inventory decisions
12 - no; futures markets not a good indicator of future events

traded in copper futures markets, 67 percent were medium-sized or larger; of the 26 dealers who did not trade, 67 percent were small operations. The most common answers to the question "If you do not trade in copper futures, why not?" were that futures markets are like gambling and are too risky for the small size of their operation. This is probably a legitimate concern for those scrap dealers whose standard transaction is much smaller that the size of the copper contract.

Although less than half of those interviewed actually participate in futures trading, over 60 percent of the firms said that they did use the futures prices generated on the markets to guide production and inventory decisions.

Even though this interview was of an informal nature, it does provide one valuable piece of information in defense of the theoretical arguments on the benefits of futures trading outlined in Section 6. That is, futures markets can confer benefits on participants in those markets as well as non-participants. For the participants, a futures market provides a means of managing risk in an uncertain market environment, and for non-participants, a futures market generates future market information that can be used as guidelines for making rational production, consumption, and inventory decisions.

APPENDIX G. COMPARISON OF SUPPLY ELASTICITIES

The econometric evidence on the impact of futures trading on the supply of plywood suggested that the supply equation for plywood took the following general form:

(1) ... $Q = a + bP_1 + cP_2$

where: Q = the quantity of plywood supplied
P_1 = the price of plywood in the pre-futures trading period
P_2 = the price of plywood in the post-futures trading period

In the analysis presented in Appendix E, coefficients b and c were both found to be positive, with c greater in value than b. In essence, equation (1) defines two supply curves for plywood. The question to be resolved here is whether the elasticities of the two curves can be compared in any meaningful way?

To demonstrate the comparison of the supply elasticity before futures trading to the elasticity after futures trading, begin with the definition of an elasticity:

(2) ... $E_s = (dQ/dP)(P/Q)$

The term (dQ/dP) for the pre-futures trading period equals b. By substituting equation (1) into equation (2) (the term cP_2 drops out since it is equal to 0 in the pre-futures trading period) and substituting b for (dQ/dP_1), the elasticity for the pre-futures trading period becomes:

(3) ... $E_{sp} = bP_1/(a + bP_1)$

If a is positive, the elasticity given by equation (3) is less than one and approaches one in the limit as P_1 approaches infinity.

The supply elasticity for the post-futures trading period can be computed in a similar manner:

(4) ... $E_{sa} = cP_2/(a + cP_2)$

To compare the two elasticities, E_{sp} and E_{sa}, set P_1 equal to P_2 and call this price P. Then the comparison is between: $[bP/(a + bP)]$ and $[cP/(a + cP)]$. Since c is greater than b, it can be written as b + r, where r is a small positive constant. By substituting the expression b + r for c the following inequality results:

(5) ... $bP/(a + bP) < (bP + rP)/(a + bP + rP) < 1$

The interpetation of equation (5) is that at any given price the pre-futures trading supply curve has a lower elasticity than the post-futures trading supply curve, which in turn is less than unity.